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A monthly publication of the Geological Survey
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The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Directory of the Office of Management and Budget through September 30, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey, MS 421
Reston, VA 22092

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05 WATER QUALITY MANAGEMENT AND PROTECTION

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06 WATER RESOURCES PLANNING

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

SATURATED VAPOR PRESSURE OF WATER AND ACTIVITY COEFFICIENTS OF CALCIUM CHLORIDE IN THE CACL2-H20 SYSTEM AT 423-623K,
Leningrad Technological Insti. (USSR).
V. I. Zarembo, S. N. L'vov, and M. Yu. Matuzenko.
Geochemistry International, Vol 17, No 2, p 159-162, 1980. 3 Fig, 3 Tab, 7 Ref.

Descriptors: *Vapor pressure, *Calcium chloride, *Activity coeffieient, Water vapor, Geochemistry, Physical properties, Temperature effects, Electrolytes.

The saturated vapor pressure of water and the activity coefficients of CaCl2 in CaCl2-H20 systems were determined with a new high pressure autoclave design which measures the temperature of the test liquid more accurately than previous equipment. The saturated water vapor pressures of pure water at tempertures of 415.91 to 624.71 K ranged from 0.3906 to 16.849 MPa and agreed closely with data reported in the literature. The saturated vapor pressures above aqueous solutions of CaC12 were reported for 7 concentrationss (0.246 to 5.536 mol per 100 g water) and temperatures of 423, 473, 523, and 623 K. These ranged from 0.47 MPa at the lowest concentration and temperature to 12.95 Mpa at the highest concentration and temperature. Mean molar activity coefficeients of CaC12 in the system (0.25 to 5.56 mol per 100 g H20) at the same temperatures ranged from 0.344 at the lowest concentration and temperaure to 0.005 at the highest concentration and temperature. (Cassar-FRC)
W83-01250

1B. Aqueous Solutions and Suspensions

SATURATED VAPOR PRESSURE OF WATER AND ACTIVITY COEFFICIENTS OF CALCIUM CHLORIDE IN THE CACL2-H20 SYSTEM AT 423-623K,
Leningrad Technological Insti. (USSR).
For primary bibliographic entry see Field 1A.
W83-01250

2. WATER CYCLE

2A. General

APPLICATION OF SACRAMENTO RIVER FORECAST MODEL TO AN INDIAN CATCHMENT,
Meteorological Office, New Delhi (India).
S. K. Gosain, and S. D. S. Abbi.
Mausam, Vol 31, No 1, p 55-64, January, 1980. 6 Fig, 1 Tab, 4 Ref.

Descriptors: *Model studies, Rivers, *Forecasting, *River forecasting, Catchment areas, Catchment basins, Watersheds, River basins, *Sacramento River Forecast Model, *India, Yamuna catchment.

The Sacramento model, a conceptual watershed model, has been applied successfully to the upper Yamuna catchment for runoff simulation at the Kalanaur outlet point. The model enables the calculation, in six-hourly values, of water transfer (interception, evapotranspiration, percolation), of the state of different phases of the water cycle, and of the flow at the outlet of the area (direct runoff, surface runoff, interflow and baseflow). Mathematical functions used in the model formulation in order to represent the physical processes taking place in the catchments, have been described in detail. The physical description of various model parameters and methods of their evaluation are also given. (Baker-FRC)
W83-01386

APPLICATION OF DETERMINISTIC CONCEPTUAL MODEL FOR WATER BALANCE STUDIES,
Meteorological Office, New Delhi (India).
S. D. S. Abbi, A. K. Gosain, and P. Narayanan.
Mausam, Vol 31, No 2, p 191-200, April, 1980. 2 Fig, 9 Tab, 2 Ref.

Descriptors: *Model studies, *Hydrologic budget, *Soil moisture, Moisture availability, Runoff, Sacramento Model, *India, Dandavathy, Tungabadhara River Basin, River basins, Mathematical equations.

A study was made of the water balance of Dandavathy, a tributary of the Tungabadhara river basin in Karnataka. The Sacramento model, a deterministic conceptual model, was applied for the study. In this technique precipitation and evaporation data have been used to allocate the moisture in various layers of the soil; the resultant runoff was compared with the actual runoff for the purpose of the calibration of the model. The model was then used to study the water balance by the well known hydrologic equation, and the results were found to be very encouraging. (Baker-FRC)
W83-01387

2B. Precipitation

RADAR AND RAINGAUGE OBSERVATIONS OF OROGRAPHIC RAIN OVER SOUTH WALES,
Royal Signals and Radar Establishment, Malvern (England). Meteorological Office Radar Research Lab.
F. F. Hill, K. A. Browning, and M. J. Bader.
Quarterly Journal of the Royal Meteorological Society, Vol 107, No 453, p 643-670, July, 1981. 19 Fig, 3 Tab, 9 Ref.

Descriptors: *Orographic precipitation, *Weather, Rainfall Precipitation, Geography, *Wales, Model studies, Wind, *Radar, *Rain gages.

The Structure and mechanism of orographically enhanced frontal rain over hills of modest height are discussed using eight detailed case studies. The observations were obtained as part of a field project in south Wales in which data from a 3-dimensionally scanning radar system were combined with autographic rain gauge data. The results demonstrate that the generation of orographic rain is consistent with Bergeron's seeder-feeder mechanism, according to which raindrops from upper-level (seeder) clouds wash out small droplets within low-level (feeder) clouds formed over the hills. It is demonstrated that the orographic enhancement is strongly influenced by the low-level wind speed. The largest enhancement of rainfall occurred in association with strong winds, and also high relative humidity, below 2 km. The radar showed that over 80% of the enhancement occurred in the lowest 1.5 km above the hills. It also showed that the periods of enhanced rainfall were associated with the passage of pre-existing areas of precipitation. The precise value of the upwind rainfall rate was rather unimportant in influencing the orographic increment provided the rainfall rate upwind exceeded about 0.5 mm/hr. These findings are compared with the results of theoretical calculations based upon the washout model of Bader and Roach. (Baker-FRC)
W83-01061

COMPARATIVE STUDY AND CALIBRATION OF SENSORS FOR THE MEASUREMENT OF THE LIQUID WATER CONTENT OF CLOUDS WITH SMALL DROPLETS,
Clermont Univ., Aubiere (France).
For primary bibliographic entry see Field 7B.
W83-01091

RAINDROP AXIAL RATIOS,
Illinois Inst. of Natural Resources, Champaign.
A. R. Jameson, and K. V. Beard.
Journal of Applied Meteorology, Vol 21, No 2, p 257-259, February, 1982. 2 Fig, 19 Ref.

Descriptors: *Rain, *Shape, Radar, Axial ratios, Polarization, Oscillation, Data interpretation, Remote sensing, Rainfall, Raindrops.

The equilibrium axial ratios of naturally falling raindrops varied from 0.70 to 1.46, mean 1.08, indicating a spherical, slightly prolate shape. This differed from previous reports of the equilibrium slope of raindrops in a laminar flow wind tunnel or still air. These drops had mean axial ratios on the order of 0.8, indicating a more oblate shape. The deviations can affect results of radar polarization measurements in rain, which depend on assumed drop shapes. (Cassar-FRC)
W83-01092

PRECIPITATION DATA FOR BURIAL GROUNDS 5 AND 6, OAK RIDGE NATIONAL LABORATORY, TENNESSEE, 1976-1980,
Geological Survey, Knoxville, TN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-01183

RAINFALL VARIATION ANALYSIS AND OPTIMIZATION OF GAGING SYSTEMS,
Agricultural Research and Education Center, Belle Glade, FL. Dept. of Agricultural Engineering.
S. F. Shih.
Water Resources Research, Vol 18, No 4, p 1269-1277, August, 1982. 4 Fig, 6 Tab, 13 Ref.

Descriptors: *Rainfall, *Variation analysis, *Gaging, Gaging stations, Gages, *Rainfall distribution, *Rain gages, Water resources development.

A general methodology is developed to compute the variance of mean rainfall using a covariance factor among rain gage stations. The relative variance, which can be reduced by increasing the density of the network, is presented as three cases: random sample method, stratified sample method without optimum allocation, and stratified sample method with optimum allocation. A special stratum-weighted ratio is also developed for allocating the gages to the substratum. On the basis of two-stage sampling theory, new methods are developed to decide the number of gages needed to estimate the mean rainfall with a given confidence level to achieve a specified accuracy. The stratified sample method required fewer stations to achieve the same level of statistical accuracy compared to the random method. In designing the rain gage network system, three steps are involved: preliminary design, allocation of the gages to substratum, and improvement of the gage density according to the expected level of statistical accuracy. Three classes with low, medium, and high density of rain gage network design are recommended in accordance with the desired level of statistical accuracy. A nonlinear relationship prevails between the increase in number of gages and the improvement in statistical accuracy. (Baker-FRC)
W83-01202

HIGH INTENSITY RAINFALLS IN NZ,
Ministry of Works and Development, Christchurch (New Zealand).
A. I. Tomlinson.
Soil and water, Vol 16, No 3, p 22-23, June, 1980. 2 Fig.

Descriptors: *Rainfall intensity, *Frequency analysis, *Prediction, *New Zealand, Weather data collections, Weather, Rainfall, Storms.

The Meteorological Service and the Water and Soil Division of the Ministry of Works and Development recently set about a joint project to produce a set of up to date figures giving the frequency of high intensity rainfalls in New Zealand. From time to time extreme rainfalls occur which are claimed to be, for example, 1000 yr falls. Two factors must considered. First, if a rainfall is claimed to have a 1000 year return period, this means that the fall will be equalled or exceeded on the average of once every 1000 years. This implies a knowledge of what will happen once every 1000 years on the basis of rainfall measurements over the last 100 years or so. Such a claim is subject to

very large uncertainty. Secondly, 1000 year return period rainfalls, or those claimed to be of this variety, seem to occur too often. This is because the statistical procedures used to compute the size of rainfalls of return periods up to 100 years do not apply to the very extreme rainfalls. In order to get an estimate of the upper limit for rainfalls of return periods of more than 100 years, one can examine the maximum recorded rainfalls throughout New Zealand. Events in recent years may lead one to think that extreme rainfalls are becoming more frequent. (Baker-FRC)
W83-01295

TECHNICAL MANUAL FOR GROUNDWATER EXPLORATION IN ARID AND SEMIARID REGIONS USING LANDSAT VISUAL AND DIGITAL ANALYSES,
Greenhorne and O'Mara, Inc., Riverdale, MD.
For primary bibliographic entry see Field 7A.
W83-01356

DIURNAL VARIATION OF RAINFALL IN THE UPPER CATCHMENTS OF NORTH BENGAL RIVERS,
Flood Meteorological Office, Jalpaiguri (India).
P. K. Bhattacharya, and S. G. Bhattacharyya.
Mausam, Vol 31, No 1, p 51-54, January, 1980. 1 Fig, 2 Tab, 6 Ref.

Descriptors: *Rainfall, *Diurnal distribution, *Catchments, Rainfall distribution, Monsoons, Distribution, *India, Rivers, Bengal, Wind.

A study was made of the diurnal variation of the rainfall during the monsoon season at six selected stations in upper catchment areas of four north Bengal rivers, the Teesta, Jaldhaka, Torsa and Raidak. The study period was from 1971 to 1976. The different patterns of diurnal variation which were observed are reported. The study clearly indicates that there is a marked tendency toward occurrence of heaviest falls during night/early morning hours in the months from June to September at all the stations except Darjeeling. Therefore, the upper catchment areas may be expected to receive more water to convert to effective runoff during the night/early morning hours of the monsoon months. It appears that at the height of the monsoon when the moisture content in the air is high, the mechanism of rainfall may be influenced by katabatic flow in the night. Radiation cooling at the top of the cloud may also be helpful in accentuating the convective activity during the night. The absence of a pronounced maximum during the night at Darjeeling may be due to the fact that the station is situated on the leeward side of the hill with respect to the monsoon current, and the katabatic flow is not in opposition to the current. (Baker-FRC)
W83-01377

2C. Snow, Ice, and Frost

SNOW STRATOGRAPHY AND WATER EQUIVALENCE MEASURED WITH AN ACTIVE MICROWAVE SYSTEM,
National Bureau of Standards, Boulder, CO. National Engineering Lab.
D. A. Ellerbruch, and H. S. Boyne.
Journal of Glaciology, Vol 26, No 94, p 225-233, 1980. 8 Fig, 1 Tab, 11 Ref.

Descriptors: *Snowpack, *Stratigraphy, Physical properties, Snow cover, Sensors, Water resources development, Glaciology, *Water equivalence, Radiation, Density, Hardness, Moisture content, *Microwave measurement.

The use of an active microwave system to determine the water equivalence and stratigraphic layering of snow-pack is described. Indications of substantial near surface activity and the possibility of identifying a characteristically weak layer, called the depth-hoar layer, in the snow-pack are also reported. An FM-CW active microwave radar system operating in the frequency range 8-12 GHz is used to scatter electromagnetic radiation from surface and subsurface stratigraphic layers in the snow-pack. The amplitude of the scattered radiation as a function of depth in the snow-pack can be correlated with such physical characteristics as density, hardness, stratigraphy, and moisture content. A direct determination of snow-pack water equivalence can be made from these observations. The same procedure can be used to measure snow-pack loading (change in electrical depth) on an avalanche slope. Evidence suggests that the top of the depth-hoar layer exhibits a strong reflection which can be monitored during the snow season. There is also evidence that while the physical depth of the pack diminishes in the latter part of the season, the water equivalence remains relatively constant (densification). Finally there is evidence that the ripeness of the snow-pack could be assessed by observing the diminution of stratigraphic layers in the late season snow pack. (Baker-FRC)
W83-01060

ANALYSIS OF FREEZE-UP ICE JAMS ON THE PEACE RIVER NEAR TAYLOR, BRITISH COLUMBIA,
British Columbia Hydro and Power Authority, Vancouver. Hydroelectric Generation Projects Div.
T. Keenhan, U. S. Panu, and V. C. Kartha.
Canadian Journal of Civil Engineering, Vol 9, No 2, p 176-188, June, 1982. 9 Fig, 6 Tab, 7 Ref.

Descriptors: *Rivers, *Ice jams, *Dams, Bennett Dam, Ice formation, Peace River, *British Columbia, Canada, Temperature effects, Water temperature, Powerplants.

A description is offered of the ice jamming mechanism observed during the ice cover advance on the Peace River downstream of the W.A.C. Bennett Dam and the adjoining G.M. Shrum Generating Station. The levels of ice recorded at the jams and the results of analyses using models are presented. Since the Dam was constructed on the Peace River, the temperature of flow releases from the generating station has been 0.5 C or higher during the winter months. As a result the progression of ice cover below the dam is inhibited, and a long reach of ice-free river persists throughout the winter. During February, 1979, below normal air temperatures persisted in the area; the cover progressed to a point 130 km downstream of the dam, 19 km upstream of the Water Survey of Canada stream gauge at Taylor. This was only the second occurrence of ice cover at the town of Taylor since 1972, when an increase in generating capacity at the station raised maximum powerhouse releases to 1580 cu m/sec. A series of ice jams at the leading edge of the ice cover formed as the cover advanced, producing water levels at Taylor that approached the maximum historic summer flood levels. The ice movement, including ice cover advance and retreat, ice levels, and jam formation, were monitored and documented. The data provided an opportunity to examine various river ice simulation models and assess their applicability to the Peace River. (Baker-FRC)
W83-01103

GEOCHEMICAL DENUDATION RATES AND SOLUTE TRANSPORT MECHANISMS IN A MARITIME TEMPERATE GLACIER BASIN,
Toronto Univ. (Ontario). Dept. of Geology.
N. Eyles, D. R. Sasseville, R. M. Slatt, and R. J. Rogerson.
Canadian Journal of Earth Sciences, Vol 19, No 8, p 1570-1581, August, 1982. 2 Fig, 8 Tab, 43 Ref.

Descriptors: *Geochemistry, *Glaciers, *Solute transport, Basins, Cations, Copper, Chromium, Lead, Nickel, Trace metals, Berendon Glacier, Canada, Aeolian deposits, Mining, Milling, Cascade Range, *British Columbia, Calcium, Ion transport.

Cation and silica transport in supraglacial, subglacial, and valleyside waters from a temperate glacier fluvial system in British Columbia is reported. Dissolved cation loss from the basin of Berendon Glacier is calculated at 947 mequiv/sq meter/yr, with calcium accounting for nearly all of this loss. The geochemical denudation rate is substantially greater than the world average of 390 equiv/sq m/yr, but agrees with similar studies from the Cascade Range in the U.S. Abundant precipitation is probably responsible for the significant geochemical denudation, despite reduced chemical activity at low annual temperatures. When absorption is considered in the removal process, the major cation denudation rate increases by about 10% and doubles the loss of certain cations such as sodium. Debris-water contact time appears to exert a significant control on the cation and silica concentrations exhibited by the various water types moving through the basin. Firn, glacier ice, and supraglacial streams generally possess the lowest ionic concentrations, and subglacial streams, valleyside streams, and ponds generally contain the highest. Anthropogenic chemical input to the Berendon basin is measurable and consists of trace metal rich dust originating at a mining and milling operation close to the glacier terminus. Aeolian transport is responsible for distributing Cu, Cr, Ni, and Pb throughout the watershed. (Baker-FRC)
W83-01109

2D. Evaporation and Transpiration

SURFACE LAYERS OF AIR AND WATER AND THEIR ROLE IN HEAT AND MOISTURE EXCHANGE BETWEEN A WATER BODY AND THE ATMOSPHERE,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
G. M. Panin.
Water Resources, Vol 8, No 5, p 483-493, September-October, 1981. 7 Fig, 1 Tab, 25 Ref. Translated from Vodnye Resursy, No 5, p 45-57, September-October, 1981.

Descriptors: *Air temperature, *Water temperature, *Mathematical studies, *Heat transfer, *Mathematical models, *Specific humidity, *Moisture gradient, Surface water records, Mathematical equations, Seasonal variation, Diurnal distribution, Heat flow, Humidity, Evaporation, Baltic Sea, Caspian Sea.

Certain complications prevent the widespread use of fluctuation and gradient methods for determining the heat and moisture exchange between a water surface and the atmosphere under natural conditions, so that empirical formulas must be used. However, terms for the changes in air temperature and specific humidity in these formulas present some confusion. Since gradients of temperature and humidity should not depend on height, the equations can be rewritten to include dimensionless universal functions. Since the functions for air temperature and relative humidity coincide, only the function of temperature was examined from direct measurements. To determine the form of the function, data from a field study carried out on the Baltic Sea cost and from studies done in the open part of the Caspian Sea were used. In the case of the heat flux between the surface layer of water and the air, three types of temperature distributions were found in the surface layer of the water. These three types of distribution become important in comparing temperature measurements taken from ships and satellites. The implications of seasonal and diurnal variations on the use of these relationships are discussed. (Geiger-FRC)
W83-01113

CANOPY AIR TEMPERATURES AND EVAPOTRANSPIRATION FROM IRRIGATED AND STRESSED SOYBEANS,
Science and Education Administration, Morris, MN.
D. C. Reicosky, D. E. Deaton, and J. E. Parsons.
Agricultural Meteorology, Vol. 21, No. 2, p 21-35, January, 1980. 9 Fig, 1 Tab, 16 Ref.

Descriptors: Soil-water-plant relationships, *Irrigation requirements, *Air temperature, *Evapotranspiration, Transpiration, *Water stress, *Irrigation efficiency, Soil water, Moisture stress, Crop production, Trickle irrigation, Canopy, *Soybeans, Wilting.

When soil-water stress is severe, partial closure of plant stomates causes a repartioning of the incident energy, which often increases canopy air temperatures. The relationship of soil-water stress to air temperatures and evapotranspiration was examined in crops of irrigated and non-irrigated soybeans. Air temperature profiles were measured using calibrated thermistors and evapotranspiration was measured by portable chamber. Plant-water status was measured indirectly by linear variable displacement transducers. Measured stem-diameter changes were related to air temperature differences in the irrigated and non-irrigated canopies. Results showed as soil-water stress became more severe, canopy air temperatures in non-irrigated crops increased above those in irrigated crops. The above-canopy minus the within-canopy temperature differences between irrigated and non-irrigated fields increased during peak radiation with little change at night. During severe stress, evapotranspiration decreased 40-70% when within-canopy air temperature was related to stem-diameter shrinkage and may act as an indirect measure of plant-water status to calculate irrigation requirements under field conditions. (Geiger-FRC)
W83-01313

2E. Streamflow and Runoff

LABORATORY INVESTIGATION OF THE STRUCTURE OF THE FLOW AND BOTTOM FEATURES IN RIVER MOUTH REGIONS,
Moscow State Univ. (USSR). Hdrophysical Lab.
O. P. Petrosyan, and V. G. Ponomarenko.
Water Resources, Vol 8, No 5, p 542-545, September-October, 1981. 4 Fig, 1 Tab, 3 Ref. Translated from Vodnye Resursy, No 5, p 121-125, September-October, 1981.

Descriptors: *Slope stability, *Estuaries, *Flow pattern, *Morphology, *Fluctuations, *Mathematical studies, *Mathematical models, *Deformation, *River mouth, Slope degradation, Model studies, Slopes, Channel morphology, Flow characteristics, Bottom currents, Flow velocity, Rheology.

A model of a river mouth region was devised in the Hydrophysical Laboratory of the Moscow State University to study flow patterns and bottom features. Within hours after the start of the experiment, deformations of the bottom and slopes showed the formation of a crescent shape characteristic of mouth regions. Stabilization of the cross section in the mouth part of a canal was more prolonged compared to stabilization of the channel. An increase was observed in the standard deviation of fluctuations during formation of a ridge relief along the axis of the mouth segment of a canal. A relationship was noted between the scales of the energy-transporting eddies in turbulent flows measured near the bottom and the relief features. The scale of turbulent formations in the flow increased from the bottom to the surface and also from the beginning to the end of the experiment. (Geiger-FRC)
W83-01099

MAGNITUDE AND FREQUENCY OF FLOODS FROM SELECTED DRAINAGE BASINS IN SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 4A.
W83-01193

WATERSHEDS IN MUSKEG TERRAIN. 1. THE CHEMISTRY OF WATER SYSTEMS,
Alberta Univ., Edmonton. Dept. of Geology.
For primary bibliographic entry see Field 2K.
W83-01206

THE INFLUENCE OF LOW-ANGLED TOPOGRAPHY ON HILLSLOPE SOIL-WATER CONVERGENCE AND STREAM DISCHARGE,
Bristol Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2G.
W83-01213

PASSAGE OF FLOODS OVER RIVER FLOODPLAINS,
M. M. Gendel'man.
Hydrotechnical Construction, Vol. 15, No. 11, p 692-697, 1981-1982. 6 Fig, 2 Tab, 5 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 32-36, November, 1981.

Descriptors: *Runoff, *Model studies, *Flood profiles, *Indirect flood measurement, Mathematical studies, *Flood flow, *Topography, River forecasting, Flood routing, Flood plain management, Flow around objects, Forests, Terrain analysis, Flood plains, *USSR.

Factual information on river runoff, shows that methods of hydraulic calculations of the characteristics of flood-plain flow are not sufficiently reliable. Incorrect calculation of hydraulic resistance of the channel and flood plain may lead to substantial errors in most cases. To correct this problem, physical modeling was examined for studying the passage of floods over the floodplain of a large meandering river. The model was based on the premise that the flow in the prototype and model obey a power-function relationship between the Chezy coefficient and the Reynolds number. The model was made from and following contour lines. The upper 2-3 cm of the model were formed of concrete with a coordinate grid plotted on the surface. The model was equipped with a weir for measuring flow delivery, a baffle wall for dissipating the excess energy of mixing, point gauges for measuring the water level, a settling basin, a gate for regulating the depth, and an outlet. Three series of experiments corresponding to floods of 0.01, 0.1 and 1% probability were carried out. Comparatively low values for Froude number and rather larger values for Reynolds numbers provided at least a quantitative similarity of the model flow to the prototype. Results of studies simulating a forest terrain showed that the effects of the forest on the discharge capacity of the floodplain and channel are minimal in comparison to the effects of complex planar forms and morphological elements. On the basis of the conditions of the model floodplain flow regime, an appropriate site for the location of a hydrostation was recommended. (Geiger-FRC)
W83-01233

THE DYNAMICS OF A RIVER BEND: A STUDY IN FLOW AND SEDIMENTARY PROCESSES,
State Univ. of New York at Binghamton. Dept. of Geological Sciences.
J. S. Bridge, and J. Jarvis.
Sedimentology, Vol 29, No 4, p 499-541, August, 1982. 34 fig, 105 Ref.

Descriptors: *Flow characteristics, *Sedimentation, *Rivers, Flow profiles, Hydraulics, Hydrodynamics, Sediment transort, Fluid mechanics, *Scotland, River South Esk.

Stable scaffolding bridges spaced along the length of a bend of the River South Esk in Scotland were used to take comprehensive field measurements of flow and sedimentary processes. At river stages between about two-thirds full and bankfull, channel width, mean depth and mean flow velocity at a cross-section vary little in the streamwise direction. Flow resistance reached a maximum at these states, and the bed topography was stable and in equilibrium with flow and bedload transport. Stable flow geometry is thus related to energy conservation and to maximization of flow resistance. Detailed observations over a large range of river stages of mean velocity distributions, secondary, circulation, water surface configuration, bed shear stress and resistance to flow, bed configurations and bed load transport rates agree with much of the comparable published studies and theoretical works. Generalized physical models of flow and sediment transport in natual curved channels are demonstrated to be sound in basis and can simulate the bend studied very well. While there is a pressing need for further development of these models, the results lend confidence to their use in simulating ancient river sedimentation. Sediment deposited on point bars is the result mainly of bedload transort over a range of near-bankfull stages. The areal distribution of grain-size characteristics and bed configurations at these stages gives rise, with lateral deposition, to vertical facies sequences that vary substantially in the streamwise direction. (Baker-FRC)
W83-01249

STATISTICAL CHARACTERISTICS OF SOME INDIAN HYDROLOGIC TIME SERIES,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
A. R. Rao.
Mausam, Vol 31, No 2, p 273-286, April, 1980. 13 Fig, 9 Ref.

Descriptors: *Hydrologic systems, *River flow, *Model studies, Tropical regions, Temperate zone, Climatic zones, *India, Krishna River, Godavari River, Wabash River, Monsoons, *Statistical methods, *Indiana.

The characteristics of the monthly and annual river flows from the Krishna and Godavari Rivers in south India, and the corresponding precipitation data from several stations in the Krishna and Godavari river basins are analyzed and compared with similar data from the Wabash River. The rivers are located in the tropical monsoon region. It was concluded that the monthly flows of these two rivers are highly seasonal and cannot be considered as weakly stationary. The annual flows may be considered as weakly stationary processes. There is a much larger variability in the monthly and annual flows of Krishna and Godavari rivers compared to the Wabash river flow. The latter river is located in the temperate zone. The histograms of the monthly flows of all three rivers are highly skewed and cannot be considered to be Gaussian. The annual flow histograms are much more symmetrical. The second order properties of the Krishna and Godavari river flows are very similar to those of rainfall in the Krishna and Godavari river basins. This similarity was less evident for the data from the Wabash river basin. (Baker-FRC)
W83-01385

2F. Groundwater

AN ASSESSMENT OF THE IMPORTANCE OF SOME PARAMETERS FOR SEAWATER INTRUSION IN AQUIFERS AND A COMPARISON OF DISPERSIVE AND SHARP-INTERFACE MODELLING APPROACHES,
James Cook Univ. of North Queensland, Townsville (Australia).
R. E. Volker, and K. R. Rushton.
Journal of Hydrology, Vol 56, No 3/4, p 239-250, April, 1982. 7 Fig, 24 Ref.

Descriptors: *Saline-freshwater interfaces, *Saline water intrusion, Coastal aquifers, Aquifers, Groundwater movement, Model studies, Dispersion coefficient.

The location and shape of the steady interface in a coastal aquifer discharging fresh water into the sea are considered. For homogeneous isotropic aquifers the interface location is obtained by the boundary integral method for an abrupt interface model, which assumes that salt water and fresh water are immiscible fluids. Results from this model and miscible fluid models are compared for a variety of aquifer parameter values. The influence of controlling parameters on the shape and location of the interface is examined. For a given fresh water discharge, a decrease in the dispersion coefficient causes a contraction of the zone of dispersion and an upstream migration of the concentration contours near the aquifer base. For a constant dispersion coefficient, the interface becomes more diffuse and migrates inland as the fresh water discharge decreases. The relative density of seawater influences the length of intrusion into the aquifer. The width of the dispersion zone also increases with greater densities. The mean concentration contour line approaches that of the abrupt interface model when the dispersion coefficient decreases and the dispersion zone reduces in width. These conditions are valid for a constant

scalar dispersion coefficient. The same general trends also occur for a tensorial dispersion coefficient with velocity-dependent components. (Cassar-FRC)
W83-01051

GROUNDWATER BUILDUP AND DEPLETION IN ISLANDS DURING MONSOON AND SUMMER,
Center for Water Resources Development and Management, Calcutta (India). Groundwater Div.
P. Basak.
Journal of Hydrology, Vol 56, No 3/4, p 265-275, April, 1982. 7 Fig, 1 Tab, 6 Ref.

Descriptors: *Water table fluctuations, *Groundwater potential, *Islands, Groundwater level, Monsoons, Drought, Evaporation, Groundwater recharge, Recharge, *India, Reservoirs, Deltas, Aquifers, Unconfined aquifers.

Long- and short-term predictions of groundwater potential in unconfined aquifers in freshwater islands are described by closed-form analytical solutions. Solutions are obtained using Grinisky's potential and Dupuit's assumptions. Results are given in non-dimensional form. Typical locations to which these solutions are applicable are islands in reservoirs in Kerala, India, and southern Ganges delta of West Bengal, and southern Bangladesh. In these islands uniform recharge during the monsoons and uniform evaporation during prolonged droughts are prevailing conditions. (Cassar-FRC)
W83-01052

SIMILARITY SOLUTIONS OF THE POROUS MEDIA EQUATION,
Waterloopkundig Lab, Delft (Netherlands).
B. H. Gilding.
Journal of Hydrology, Vol 56, No 3/4, p 251-263, April, 1982. 1 Tab, 19 Ref.

Descriptors: *Porous media, *Groundwater movement, *Differential equations, Mathematical equations, Similarity solutions.

The porous media equation, a nonlinear partial differential equation, is used in groundwater hydrology. This paper applies a technique for determining admissable similarity transformations of this equation. The method used for the identification of admissible similarity transformations is an extension of the separation of variables technique. The transformations reduce the partial differential equations to an ordinary differential equation. These transformations produce three classes of similarity solutions from which the known explicit analytical solutions of the porous media equation may be obtained as special cases. (Cassar-FRC)
W83-01058

DECOLORIZATION OF INFILTRATION WATER UNDER NATURAL CONDITIONS,
Akademiya Nauk SSSR, Moscow. Inst. Biologii Vnutrennykh Vod.
B. A. Skopintsev.
Water Resources, Vol 8, No 5, p 558-570, September-October, 1981. 1 Fig, 7 Tab, 52 Ref. Translated from Vodnye Resursy, No 5, September-October, 1981.

Descriptors: *Color, *Groundwater runoff, *Surface runoff, *Podzols, *Humic acids, *Fulvic acids, *Organic matter, *Coagulation, Water treatment, Optical properties, Groundwater pollution, Soil types, Groundwater movement, Decomposing organic matter, Soil organic matter, Organic compounds, Separation techniques.

The content of organic matter in groundwater was studied in relation to coloration. During periods of precipitation or floods, surface waters are characterized by high color values, whereas groundwaters are usually faintly colored. If the average contribution of groundwaters to the total annual runoff is 16-24%, then the contribution of overland waters is 2-3 times more, according to data taken from 33 small rivers of the USSR. Humic acid compounds are the predominant organic compound in precipitation runoff. Fulvic acid is known to form organometallic complexes, especially in podzolic soils. Colored and turbid surface waters must be treated by coagulation with aluminum sulfate before practical use. If groundwaters are connected with perched or swamp waters or polluted water, their color and oxidizability increase. Various studies involving the extraction and fractionation of humic and fulvic acids from soils are reviewed. The variability of the ratio of the contents of humic acids/fulvic acids in different soils and the different mobility of these acids is due to hydrothermal factors which depend on the climate of different natural physiographic zones. The water regime of soils is also important in determining the ratio of these acids. Bacteria also may produce acids in soil. The differences between color formation in chernozem and podzolic soils are discussed. Organic matter of atmospheric waters that pass through the illuvium and enter groundwaters is characterized by the faintly colored fulvic acid fractions. (Geiger-FRC)
W83-01097

ISOTOPE HYDROGEOLOGY AND GEOTHERMOMETRY OF THE MOUNT MEAGER GEOTHERMAL AREA,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
I. D. Clark, P. Fritz, F. A. Michel, and J. G. Souther.
Canadian Journal of Earth Sciences, Vol 19, No 7, p 1454-1473, July, 1982. 10 Fig, 5 Tab, 46 Ref.

Descriptors: *Geothermal resources, *Sulfates, *Hydrothermal studies, Physical properties, Thermal properties, Isotopes, Resources development, Natural resources, Groundwater, Volcanoes, Thermal water, Mount Meager, *British Columbia.

A survey of stable and radioactive environmental isotopes has been carried out to investigate the recharge, thermal history, age and geothermometry of the thermal waters at Mount Meager, British Columbia, a Quaternary volcano that is currently the site of geothermal resources exploration. Chemical and isotope data indicate that the Meager Creek and the Pebble Creek thermal waters discharge from different geothermal systems. The majority of cold springs at Mount Meager discharge from seasonally variable, shallow flow systems and show a correlation between altitude and lighter isotope contents. Most cold groundwaters collected during this study contained measurable amounts of tritium, which shows that a large proportion of these waters is less than about 20 years old. Reservoir temperatures as estimated from the geochemical and isotopic geothermometers consistently indicate that the known Meager Creek and Pebble Creek thermal waters have experienced only moderate heating. Such evidence also indicates that the thermal waters of the two creeks are part of separate, shallow circulating geothermal systems. Recently a new drilled geothermal well has encountered temperatures close to 250 C at an approximate depth of 2400 m. This indicates that a significant heat source may exist which would support the conclusion that the chemistries and isotopic compositions of the springs sampled for this study do not reflect the resource potential at Mount Meager. (Baker-FRC)
W83-01102

MAP OF WATER TABLE IN SOLOMON RIVER VALLEY, WACONDA LAKE TO SOLOMON, NORTH-CENTRAL KANSAS, MAY 1980,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-01180

MAP OF WATER TABLE IN GRAHAM COUNTY, NORTHWESTERN KANSAS, MARCH 1979,
Geological Survey, Garden City, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-01181

GROUND-WATER QUALITY AND DATA ON WELLS AND SPRINGS IN PENNSYLVANIA, VOLUME III--DELAWARE RIVER BASIN,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-01185

GROUND-WATER QUALITY AND DATA ON WELLS AND SPRINGS IN PENNSYLVANIA, VOLUME II--SUSQUEHANNA AND POTOMAC RIVER BASINS,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-01186

SALINE GROUND-WATER DISCHARGE TO THE SMOKY HILL RIVER BETWEEN SALINA AND ABILENE, CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 5G.
W83-01191

INTERPRETATION OF PH AND EH TRENDS IN A FLUVIAL-SAND AQUIFER SYSTEM,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
For primary bibliographic entry see Field 2K.
W83-01201

AN ALTERNATIVE CONCEPTUAL MODEL OF GROUNDWATER FLOW,
National Hydrology Research Inst., Ottawa (Ontario).
A. Vandenberg.
Journal of Hydrology, Vol 57, No 1/2, p 187-201, May, 1982. 5 Fig, 5 Ref.

Descriptors: *Model studies, *Groundwater movement, Finite difference methods, Numerical analysis, Probability, Markov processes, Finite element analysis, Kinetic gas theory.

A conceptual model of groundwater flow is developed, based on probability and a particulate description of interstitial water. This alternative approach borrows from basic concepts, especially the kinetic gas theory, Markov chains, and finite-difference techniques. Transmissivity, storativity, and Darcy's law are not introduced. Analytical and numerical methods are considered approximations, the first permitting direct calculation of a system state at any time and location and the second requiring calculation of the system state at all previous time steps and for all elemental compartments. The conceptual model seems to merge with the standard model of groundwater flow in the finite-difference approximation to the diffusion equation. It provides insight into the nature of the stability criterion for the explicit finite-difference technique. (Cassar-FRC)
W83-01204

HEAT STORAGE IN A SHALLOW CONFINED AQUIFER: GEOPHYSICAL TESTS TO DETECT THE RESULTING ANOMALY AND ITS EVOLUTION WITH TIME,
Centre National de la Reherche Scientifique, Pouilly sur Loire (France). Centre de Recherches Geophysiques.
Y. Benderitter, and J. Tabbagh.
Journal of Hydrology, Vol 56, No 1/2, p 85-98, March, 1982. 8 Fig, 9 Ref.

Descriptors: *Aquifers, *Injection, *Heat flow, *Confined aquifers, Resistivity, Heated water, Groundwater, Model studies, Shallow aquifers, *Electrical resistivity, *France, Bonnard.

The decrease in electrical resistivity of the ground surface was used to monitor heat produced by injections of 30-40 C water into a shallow confined aquifer situated between 4 and 7 m from the surface. Measurements were taken up to 30 m from the borehole during an 11 month period of six injection, storage, and pumping cycles. The heat anomaly decreased irregularly with distance from the borehole, with time during the storage period, and after pumping. Increases were observed with

every injection. The evolution of the anomaly with space and time is indicated on maps. A model was proposed to show the effect of hot water injection into the saturated zone of the aquifer and a secondary effect of thermal leakage through the borehole lining. This method permits on-site definition of the relationship between electrical resistivity and ground temperature. (Cassar-FRC)
W83-01205

SIMULATION OF LONG-TERM TRANSIENT DENSITY-DEPENDENT TRANSPORT IN GROUNDWATER,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
E. O. Frind.
Advances in Water Resources, Vol 5, No 2, p 73-88, June 1982. 12 Fig, 18 Ref.

Descriptors: *Groundwater movement, *Model studies, Density, Mathematical models, Confined aquifers, Aquifer characteristics, Finite element analysis, Optimization, Numerical analysis.

A numerical model for the economical simulation of long-term transient response in density-dependent transport problems is introduced. Although a classical Galerkin finite element approach is used, emphasis on optimum efficiency throughout the development results in a scheme that is significantly less costly than comparable existing schemes. Some distinctive aspects of the model include the elimination of static quantities in the fluid continuity equation, achieved by the introduction of the equivilent freshwater head; and the elimination of numerical integration, achieved by the deliberate choice of linear elements. Fluid velocities are discontinuous across the element boundaries. However, the solution obtained with discontinuous velocities approaches that obtained with continuous velocities as the grid is refined, and the two types of solutions give essentially the same results when the elements are in the same size range. The model is applied to simulate the complete transient response for a well-known problem of seawater intrusion in a confined aquifer. (Baker-FRC)
W83-01220

THE HYDROGEOLOGY OF ALLUVIAL AQUIFERS IN OR BORDERING THE DISSECTED TILL PLAINS,
Missouri Univ., Columbia. Dept. of Geology.
L. L. Gorday.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139881, Price codes: A07 in paper copy, A01 in microfiche. M. A. Thesis, May 1982. 145 p, 40 Fig 7 Tab, 36 Ref, 2 Append. OWRT A-129-MO(3).

Descriptors: *Permeability coefficient, *Particle size, *Alluvial aquifers, *Geohydrology, *Groundwater movement, Missouri, Evapotranspiration, Alluvium, Pumping Tests, Till Plains.

The till plains area of northern Missouri currently has an inadequate supply of water, and the condition is expected to worsen as the demand for water grows. In this area, alluvial aquifers may be a low cost source for significant quantities of water. The two areas of direct investigation were the alluvial aquifers of Perche Creek and Goodwater Creek. The thickness of the alluvium at Goodwater Creek averaged 4.1 m, and the hydraulic conductivity of the alluvium was 6.1 x 10 to the minus 7 m/s. The yearly groundwater flow from the basin through the alluvium is 80.2 cu m/yr. A revised water budget for Goodwater Creek shows agreement with Hesemann's conclusions of a steady state system during years of average rainfall, and that evapotranspiration in the major source of discharge from the basin. In the area of the seismic line across Perche Creek the alluvium averages 17.7 m thick. The efficient grain size gives a closer relationship to the hydraulic conductivity of a sample than does either the effective grain size or the mean grain size. Pump tests indicate an average hydraulic conductivity of .000557 m/s for the Perche Creek alluvial aquifer. Preperly constructed wells in the Perche Creek alluvial aquifer could be expected to yield substantial quantities of water. The hydraulic conductivity and transmissivity of the alluvial aquiders in the region vary widely, even within local areas. Similarly the floodplain width, channel width, and depth to bedrock show great variation. (Moore-SRC)
W83-01269

NETWORK MODEL FOR OPTIMAL MANAGEMENT OF STREAM-AQUIFER SYSTEMS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W83-01366

STEADY NON-DARCY SEEPAGE THROUGH CONFINED AQUIFER OF VARIABLE THICKNESS,
Center for Water Resources Development and Management, Calicut (India).
P. Basak, and J. P. Soni.
Mausam, Vol 31, No 1, p 145-150, January, 1980. 4 Fig, 1 Tab, 24 Ref.

Descriptors: *Confined aquifers, *Seepage, *Flow characteristics, Linear flow, Darcys Law, Aquifers, Groundwater movement.

A steady state analytical solution for the case of a confined aquifer of variable thickness incorporating Forchheimer's non-linear velocity gradient response is presented. The solution is compared with the available solution for Darcian linear flow. The effect of non-linearity in the flow response on the discharge characteristics and the piezometric pressure distribution in relation to the corresponding linear case is brought out. (Baker-FRC)
W83-01378

2G. Water In Soils

STABILITY ANALYSIS OF WATER MOVEMENT IN UNSATURATED POROUS MATERIALS. I. THEORETICAL CONSIDERATIONS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
G. A. Diment, K. K. Watson, and P. J. Blennerhassett.
Water Resources Research, Vol 18, No 4, p 1248-1254, August, 1982. 3 Fig, 1 Tab, 21 Ref.

Descriptors: *Groundwater movement, *Capillarity, *Model studies, *Stability analysis, Porosity, Soil water, Hydrodynamics, Mathematical studies, *Porous media, Mathematical equations.

An adequate stability analysis for flow in unsaturated porous materials was sought. The principles of hydrodynamic stability analysis are summarized and then used to develop a linear perturbation equation for vertical water movement with nonsharp fronts. A numerical approach for determining the stability parameters involving the eigenvalues of a matrix solution is outlined. The numerical results are checked against an analytical solution for a profile exhibiting a uniform distribution of capillary potential. The method as developed is general in its application and is able to be used in analyzing instabilities in systems exhibiting nonsharp fronts. Characteristics of the present method include the specification of the soil water data of the porous media, the minimizing of time effects by the introduction of a moving coordinate system, and the use of eigenvalues in the solution. (Baker-FRC)
W83-01200

THE INFLUENCE OF LOW-ANGLED TOPOGRAPHY ON HILLSLOPE SOIL-WATER CONVERGENCE AND STREAM DISCHARGE,
Bristol Univ. (England). Dept. of Geography.
M. G. Anderson, and P. E. Kneale.
Journal of Hydrology, Vol 57, No 1/2, p 65-80, May, 1982. 12 Fig, 1 Tab, 21 Ref.

Descriptors: *Soil water potential, *Topography, *Stream discharge, Hydrologic maps, Hill and spur topography, Shallow topography, Discharge, Storms, Slopes, Hydrographs, Bristol, *England, Convergence, Infiltration, Catchments, Subsurface drainage.

A significant spatial shift occurred in the focus of soil-water convergence on a 6 degree hill slope with relatively minor hollow and spur topography. An empirical investigation was undertaken in a 0.8 sq km catchment near Bristol, England, over a 3-year period. Weirs divided the channel into four subcatchments: straight 4 degree slope, spur and hollow 2-6 degree slope, straight 6-10 degree slope, and spur and hollow 6-10 degree slope. The contribution of each subcatchment to the hydrograph varied during a given storm as the focus of convergence (as shown by soil water potential isolines) shifted from the center of the hollow towards the downstream spur and back again to the center over a period of several days. The period required for the focus to shift back toward the center of the hollow was longer in larger storm events, up to 8 days, than in smaller events, 2 days. These variations may be attributed to antecedent conditions controlling the focus location. This study shows the necessity for more accurate topographic indices for the identification of hillslope partial area zones in shallow topography. (Cassar-FRC)
W83-01213

CHEMICAL INTERACTIONS BETWEEN FOREST SOILS AND ACIDIC PRECIPITATION DURING A DORMANT SEASON ON WILDCAT RUN WATERSHED IN SOUTHWESTERN PENNSYLVANIA,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 2K.
W83-01236

CONSERVATION TILLAGE EFFECTS ON WATER CONSERVATION,
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W83-01240

THE SEPTIC TANK AS A WASTEWATER TREATMENT AND DISPOSAL FACILITY,
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
For primary bibliographic entry see Field 5D.
W83-01241

A WEIGHING LYSIMETER FOR USE IN ISOLATED FIELD AREAS,
Science and Education Administration, Stoneville, MS.
L. G. Heatherly, B. L. McMichael, and L. H. Ginn.
Agronomy Journal, Vol. 72, No. 5, p 845-847, September-October, 1980. 2 Fig, 1 Tab, 11 Ref.

Descriptors: *Lysimeters, *Water loss, *Evapotranspiration, Cotton, Soybeans, Soil water, Field tests, Measuring instruments.

A weighing lysimeter, designed for field studies, requires no power source or constant maintenance. A 60 x 60 x 120 cm deep box hangs from a crane scale suspended from a tripod. The only necessary maintenance is periodic levelling of the suspended box by adjusting turnbuckles at each corner, necessary because the tripod legs settle differentially. Measurements of rainfall (in mm) by lysimeter and rain gage, respectively, during three periods in summer were: 13.4 and 13.8, 61.9 and 70.6, and 26.0 and 29.5. Soil water contents in lysimeters planted with soybeans were close to those of surrounding soil at the 30, 60, and 90 cm levels. Highest water losses were seen during the first 46 days of soybean growth and during the period following the first bloom in cotton. Total seasonal water losses were 54.8 cm from cotton lysimeters and 46.5 cm from soybean lysimeters, or 0.45 and 0.38 cm per day, respectively. (Cassar-FRC)
W83-01308

A FIELD TEST OF A CONCEPTUAL COMPUTER SIMULATION MODEL FOR PREDICTING WATER AND SALT DISTRIBUTION,
Winter Rainfall Region, Stellenbosch (South Africa).
J. H. Moolman, and D. J. Beukes.

Irrigation Science, Vol. 2, No. 1, p 33-47, 1980. 8 Fig, 6 Tab, 11 Ref.

Descriptors: *Model studies, *Soil moisture, *Salinity, Soil properties, Soil types, Flow, Chemical properties, Computers, Physical properties, Unsaturated flow, Flow.

The unsaturated flow and unsaturated chemistry submodels of a conceptual computer simulation model developed to predict water and salt behavior in soils were tested under field conditions. The comparison of results was done with data obtained from an irrigation trial with alfalfa over a four year period. The model simulated the actual physical and chemical processes taking place in the soil with a fair degree of accuracy. The predicted moisture contents compared reasonably well with observed data, especially in the soil layers between 480 and 1200 mm. The simulation of moisture distribution was more accurate for plots receiving a high irrigation frequency than for plots given a low irrigation frequency. On a depth-weighted-mean scale, the predicted salt concentration of the soil layers shallower than 1200 mm was within 11% of the observed data. However, when the salt content of the soil layers between 1200 and 1920 mm was taken into account, the percentage error increased to about 40%. The results indicate that this simulation model can be extremely useful in predicting the long and short term effects of irrigation water on the root zone of a soil. However, field data are always needed to calibrate the unsaturated flow model for specific soil types. (Baker-FRC)
W83-01309

A CONCEPTUAL MODEL OF WATER TRANSPORT THROUGH UNSATURATED SOIL ZONE,
Physical Research Lab., Ahmedabad (India).
P. S. Datta, S. K. Gupta, and S. C. Sharma.
Mausam, Vol 31, No 1, p 9-18, January, 1980. 10 Fig, 1 Tab, 12 Ref.

Descriptors: *Water transport, *Soil water, *Model studies, Mathematical studies, Unsaturated flow, *India, Indo-Gangetic plains.

A simple conceptual model of water transport in the unsaturated soil zone is presented. In the model the transport of water is visualized in pulses of infiltrating sheet through a series of interconnected expandable mixing cells. By applying the mass balance equation successively to each hypothetical mixing cell, sub-dividing the soil profile at discrete time intervals, the process of dispersion and mixing during transport of water through the zone is mathematically approximated. Simulation of tritium tracing experiments in Indo-Gangetic plains of north India using the above model closely reproduced field data. A close correlation was seen to exist between the rainfall and the estimated number of recharge pulses from the field data. (Baker-FRC)
W83-01376

2H. Lakes

THE PHYTOPLANKTON OF SOME FRESHWATER BODIES FROM ZULIA STATE (VENEZUELA),
Universidad Nacional del Zulia, Maracaibo (Venezuela).
S. Yacubson.
Nova Hedwigia, Vol 33, No 1-2, p 279-339, 1980. 193 Fig, 75 Ref.

Descriptors: *Algae, *Chlorophyta, *Cyanophyta, *Venezuela, *Surveys, *Lakes, *Taxonomy, *Hydrobiology, Phytoplankton, Desmids, Euglenophyta, Ponds, Species Composition, Classification, Inland waterways.

Studies were carried out on the phytoplankton of some inland waters of the western part of Zulia State, Venezuela. Algae were collected in fine Mesh silk nets from the Rio Limon drainage area between the Mara and Paez districts. Algae from many aquatic environments such as brooks, pools, and standing water bodies situated in the vicinities of the main biotopes were also examined. Of the 211 taxa described, 27 are Cyanophyta and 117 are Chlorophyta, of which 73 are Desmids and 67 are Euglenophyta. Sixteen of the taxa are reported as new to science, and 110 representing 7 genera are registered here for the first time in Venezuela. The descriptions are supplemented with diagrams and photomicrographs. (Geiger-FRC)
W83-01063

ALGAL GROWTH STIMULUS BY PHOSPHORUS IN FLATHEAD LAKE, MONTANA, SEDIMENTS,
Montana Univ., Flathead Lake. Biological Station.
For primary bibliographic entry see Field 5C.
W83-01065

SEDIMENTATION IN AN ARTIFICIAL LAKE - LAKE MATAHINA, BAY OF PLENTY,
Waikato Univ., Hamilton (New Zealand). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2J.
W83-01084

LIMNOLOGY OF OPAL LAKE,
Scientific and Industrial Research, Taupo (New Zealand), Ecology Div.
D. J. Forsyth, and A. L. MacKenzie.
New Zealand Journal of Marine and Freshwater Research, Vol 15, No 3, p 279-283, 1981. 4 Tab, 14 Ref.

Descriptors: *Lakes, *Limnology, *Benthic environment, Benthos, Benthic fauna, Benthic flora, Aquatic life, Aquatic plants, Aquatic animals, Natural waters, Phytoplankton, Acidity, Macroinvertebrates, *New Zealand, Opal Lake, *Acidic Water.

Opal Lake is strongly acidic but with no apparent geothermal inputs. It occupies a hydrothermal explosion crater at the northern base of Maungakakarames and has an area of 0.54 ha. It is about 140 meters long and 50 meters wide with a maximum depth of 5.5 meters, a mean depth of 3.3 meters and a catchment area of about 55 ha. Water was sampled in September of 1976 and in March and November of 1977. The biota of Opal Lake was limited in the number of taxa but not necessarily in abundance and was more typical of other acid lakes of the region. A greater phytoplankton species diversity was noted in Opal Lake than in neighboring Lake Rotokawa. Opal Lake supported submerged macrophytes, but the acidic water appeared to be limiting to some groups normally present in the fauna of lentic waters. The mean standing crop of 6240 benthic macroinvertebrates per square meter was greater than population densities given for local meso-eutrophic lakes. The macroinvertebrate population was comprised of more than 98% chironomid larvae represented by 4 species. Molluscs were absent. (Baker-FRC)
W83-01116

NUTRIENT ENRICHMENT OF SEAGRASS BEDS IN A RHODE ISLAND COASTAL LAGOON,
Rhode Island Univ., Kingston. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W83-01129

SIMPLE TROPHIC STATE CLASSIFICATION OF THE CANADIAN NEARSHORE WATERS OF THE GREAT LAKES,
Canada Centre for Inland Water, Burlington (Ontario).
For primary bibliographic entry see Field 5C.
W83-01199

THE ESTABLISHMENT OF WATER QUALITY GRADIENTS IN RESERVOIRS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 5B.
W83-01222

PATTERNS OF CIRCULATION AND NUTRIENT SUPPLY IN A MEDIUM RESIDENCE-TIME RESERVOIR KOOTENAY LAKE, BRITISH COLUMBIA,
National Water Research Inst., Vancouver (British Columbia).
E. C. Carmack, and C. B. J. Gray.
Canadian Water Resources Journal, Vol 7, No 1, p 51-70, 1982. 7 Fig, 1 Tab, 14 Ref.

Descriptors: *Water circulation, *Nutrients, *Reservoirs, Kootenay Lake, *British Columbia, Canada, Lakes, Physical properties, Chemical properties, Rivers, Seasonal variations, Mixing, Wind, Overflow, Underflow.

Kootenay Lake, a long, deep lake in the Columbia River System, is a medium residence time system in which the physical and chemical characteristics are influenced by the two major rivers in the area. The interactive effects of three separate processes must be studied in order to understand seasonal circulation patterns. These processes are mixed-layer dynamics, internal wave behavior and the riverine circulation. Incoming river water may move laterally through the lake as a surface overflow, an intermediate depth interflow or a near-bottom underflow. Vertical redistribution of riverine water masses is dependent upon surface driven processes. The combined effect of both of the above processes may be altered still further by internal seiche motions, which can reposition various layers within the lake relative to the surface, where wind mixing is more intense. Construction of dams on both upstream rivers has led to changes in the timing and temperature of discharge to the lake. To predict the effects of alterations in riverine nutrient loadings on the primary producers, the nutrient supply of phosphorus and nitrogen was compartmentalized on the basis of physical processes controlling distribution during various times of the year. The compartments were the epilimnion starting load, river inputs during summer growing season and inputs from entrainment of metalimnetic water during autumnal cooling. (Baker-FRC)
W83-01223

PHYTOPLANKTON COMPOSITION AND DISTRIBUTION AS AN EXPRESSION OF PROPERTIES OF RESERVOIRS,
Barcelona Univ. (Spain). Dept. of Ecologia.
R. Margalef, M. Mir, and M. Estrada.
Canadian Water Resources Journal, Vol 7, No 1, p 26-50, 1982. 6 Fig, 4 Tab, 11 Ref.

Descriptors: *Reservoirs, *Water quality, *Monitoring, *Phytoplankton, Sedimentation, Sediments, Aquatic plants, Chemical properties, Water analysis, *Spain, Physical properties, *Bioindicators.

Counts were made of some 335 sedimented samples of phytoplankton collected in 91 Spanish reservoirs. More than 250 species were recognized. A principal component analysis was performed on the correlation matrix of the log-transformed densities of 41 species or groups of species. The second component is related to mineralization, the third component to the fertility of water, and the fourth to the degree of stratification. The major purpose of the study was to determine whether phytoplankton data could reveal the structure of the piece of nature under description and consideration. The ultimate value of phytoplankton communities as indicators of water quality depends on the reliability with which identification can be made of some principal directions of variability in relationship with factors or complexes of factors of the environment. The convergence in the results of the different approaches that have been proposed and applied to non-coincident samplings in Spanish reservoirs seems to support the soundness of the approach. Chemical parameters may be easier to measure for the purpose of monitoring, but phytoplankton composition may offer very useful complementary indications. (Baker-FRC)
W83-01224

WATER RENEWAL EFFECTS ON RESERVOIR ZOOPLANKTON COMMUNITIES,
Oklahoma Univ., Kingston. Biological Station.
S. T. Threlkeld.

Canadian Water Resources Journal, Vol 7, No 1, p 151-167, 1982. 5 Fig, 2 Tab, 31 Ref.

Descriptors: *Reservoirs, *Zooplankton, *Water quality, Dilution, Limnology, Light penetration, Temperature effects, Texas, Oklahoma, Tennessee, Arkansas, Montana, Cladocerans.

Water renewal may influence reservoir zooplankton communities through the mechanisms of dilution or transport or through localized modifications of limnological conditions which then provide the setting for alteration of zooplankton community structure. An inverse relationship was noted between reproduction in cladoceran zooplankton and water renewal time for six reservoirs sampled during the summer of 1980. This relationship suggests a strategic response in renewal. However, analysis of variation in cladoceran demography at different sites within each of the reservoirs and over a four month period at a single site in one reservoir demonstrated that reproductive variation could be explained by spatial or temporal variation in limnological conditions and independent of transport or dilution processes associated with water renewal. (Baker-FRC)
W83-01226

MATHEMATICAL MODEL FOR DISSOLVED OXYGEN IN THREE SOUTHERN ONTARIO RESERVOIRS,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W83-01227

SPATIAL VARIATIONS IN ABUNDANCE OF PHYTOPLANKTON, ZOOPLANKTON, AND LARVAL FISHES IN CENTER HILL RESERVOIR,
Georgia Univ., Athens.
M. J. Van Den Avyle, R. S. Hayward, R. A. Krause, and A. J. Spells.
Canadian Water Resources Journal, Vol. 7, No. 1, p 189-214, 1982. 8 Fig, 8 Tab, 12 Ref.

Descriptors: *Aquatic life, *Spatial distribution, *Reservoirs, Zooplankton, Phytoplankton, Population dynamics, Fish, Center Hill Reservoir, *Tennessee, Lakes, Seasonal variation.

Densitites of phytoplankton, zooplankton, and larval fishes in Center Hill Reservoir, Tennessee, were determined to evaluate differences in abundance between embayments and mainstream areas and to assess longitudinal gradients in the reservoir. Plankton were collected monthly from May 1978 through June 1979, and larval fishes were collected biweekly from May through August 1978 at five mainstream and five embayment sites established along the reservoir. Statistical analyses for the majority of plankton and larval fishes indicated that spatial variations in abundance were primarily related to localized environmental conditions rather than the hydraulic gradient of the reservoir. Most taxa were more abundant in embayments than in nearby mainstream sites, and although abundance usually varied significantly among the five mainstream stations, densities showed no consistent gradient in the upstream-downstream dimension of the reservoir. Abundance of phytoplankton and rotifers was more uniform at the mainstream stations during periods of low inflow and high water temperature. Copepod and cladoceran densities, however, were more uniform during periods of high inflow. The existence of spatial variations in biological communities should be recognized when assessing trohic status or developing predictive models of reservoir systems. (Baker-FRC)
W83-01230

LAKE ERIE OXYGEN; THE PREHISTORIC RECORD,
National Water Research Inst., Burlington (Ontario).
L. D. Delorme.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 39, No. 7, p 1021-1029, July, 1982. 6 Fig, 8 Tab, 19 Ref.

Descriptors: *Lakes, *Eutrophication, *Anoxia, Periodic anoxia, Ostracods, Inorganic carbon, Organic carbon, Carbon, *Lake Erie, Great Lakes, Oxygen, Dissolved oxygen.

In the central basin of Lake Erie, periodic anoxia as a symptom of eutrophication has lasted for hundreds or thousands of years. Fossil ostracod remains in sediment cores show that a common species, Candona caudata, has survived in spite of periodic anoxia due to its tolerance to low dissolved oxygen and a short life cycle of weeks to several months. These qualities have enabled it to survive at levels below 2.3 mg/liter. Two species expected to be found but not found were Candona subtriangulata and Cytherissa lacustris. These could not cope with the periodic low oxygen levels. This condition appears to have been common in the lower part of some of the sediment cores examined. A time-transgressive change in carbon concentration occurred in the surficial sediments of the central basin. A decrease in carbon started in the Sandusky basin around 4000 yr ago and gradually extended itself to the middle of the central basin by 1220 A.D. The loss of carbonate in the upper part of the sediment profile probably resulted from trapping of carbon dioxide, produced by the decomposition of organic material by oxidation and bacterial activity in the hypoilimnion. (Baker-FRC)
W83-01231

USE AND LIMITATIONS OF SEDIMENTARY PIGMENTS AS INDICATORS OF PAST LAKE PRODUCTIVITY,
Massachusetts Univ., Amherst. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W83-01237

210PB GEOCHRONOLOGY AND TRACE METAL CONCENTRATIONS OF SEDIMENTS FROM UPPER KLAMATH LAKE AND LAKE EUWANA, OREGON,
Geological Survey, Corpus Christi, TX.
For primary bibliographic entry see Field 2J.
W83-01252

BACTERIAL ENRICHMENTS IN SURFACE FILMS OF FRESHWATER LAKES,
Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
R. L. Crawford, L. Johnson, and M. Martinson.
Journal of Great Lakes Research, Vol 8, No 2, p 323-325, 1982. 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Bacteria, *Trophic level, *Air-water interfaces, Lakes, Surface film, *Lake Superior, Oligotrophic lakes, Eutrophic lakes, Transparency, Enrichment, Films.

Some highly transparent lakes showed small enrichments of total bacteria or benzoic-acid-degrading bacteria in the 10-100 micron thick surface layer as compared with subsurface water (0.1 m depth). More eutrophic lakes did not show significant enrichment of bacteria in the surface film. A relationship was developed between Secchi disc depth (1-10 m) and enrichment factor (8 to 24) for a series of lakes. In midsummer bacterial numbers in Lake Superior (highly transparent) were 1.1 billion per ml in the surface film and 47 million per ml in the subsurface layer; in Lake Independence (Secchi depth 1 m), 280 million per ml in the surface film and 29 million per ml in the subsurface layer. (Cassar-FRC)
W83-01261

FRACTIONATION OF HYDROPHOBIC ORIGIN MATERIALS IN SURFACE MICROLAYERS,
Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
For primary bibliographic entry see Field 5B.
W83-01266

MODELS OF PARTICLE DRY DEPOSITION TO A LAKE SURFACE AND SOME EFFECTS OF SURFACE MICROLAYERS,
Illinois Univ. at the Medical Center, Chicago. School of Public Health.
For primary bibliographic entry see Field 5B.
W83-01267

LIMNOLOGY OF MT. ELBERT FOREBAY 1978-79,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
J. R. Boehmke, J. F. LaBounty, J. J. Sartoris, and R. A. Roline.
Report REC-ERC-82-6, March 1982. 25 p, 15 Fig, 11 Tab, 8 Ref, 1 Append.

Descriptors: *Limnmology, *Reservoirs, *Pumped storage, *Plankton, *Benthos, Nitrogen compounds, Phosphorus compounds, Iron, Zinc, Thermal strtification, Environmental effects, Dissolved solids, Colorado.

The forebay for Mt. Elbert Pumped-Storage Powerplant is located about 137 m above Twin Lakes, Colorado. Prior to the forebay construction, the area consisted of sagebrush, sandy soil, and stands of aspen. The constructed bottom was a 1.5-m thick compacted sandy-silt liner; however, in the fall of 1980, a chlorinated polyethylene (CPE) liner was added to decrease seepage. In 1977-78, the forebay was filled to 19% capacity with water pumped from Twin Lakes. Throughout the duration of the limnological study (November 1978-September 1979), the forebay had neither an inlet nor an outlet. It was found to be a cold monomictic impoundment. The forebay was higher in dissolved substances, and nitrogen and phosphorus compounds, but lower in abundance of plankton and benthic organisms than the afterbay. A possible cause of lesser abundance of organisms is higher concentrations of iron and zinc that were found in the forebay. This study provides baseline data to help determine environmental effects of the CPE liner. Limnological studies will be continued on the forebay and Twin Lakes to determine ecological effects of pumped storage. (Moore-SRC)
W83-01268

THE INFLUENCE OF ALGAL GROWTH AND OTHER ECOLOGICAL FACTORS IN RESERVOIRS ON THE PRODUCTION AND CONTROL OF TRIHALOMETHANE PRECURSORS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W83-01279

FRESHWATER RED ALGAE A NEW ADDITION TO THE IRAQI FLORA,
Sulaimaniyah Univ. (Iraq). Dept. of Biology.
G. C. F. Hinton, and B. K. Maulood.
Nova Hedwigia, Vol. 33, No. 1-2, p 487-497, 1980. 4 Fig, 16 Ref.

Descriptors: *Hydrobiology, *Algae, *Iraq, *Taxonomy, *Aquatic habitats, *Rhodophyta, Phytoplankton, Species composition, Aquatic life, Species diversity, Habitats, Deep-water habitats, Audouinella violacea.

The distribution of five previously unrecorded red algal genera in Iraq was recorded in studies that sampled most types of aquatic habitats of the country. Of the 50 sites investigated only ten sites contained freshwater red algae. Audouinella violacea was the most widely distributed taxon in the mountainous region in Iraqi Kurdistan. Compopogon, a common genus of warmer waters, was found at only two of the sites investigated in Iraq. Thorea was very rare; its appearance was transitory in early summer and confined to swiftly flowing waters. The lack of shaded habitats in the hot Iraqi summers probably accounts for the scarcity of Batrachospermum which was found at only three sites. Hildenbrandia was also restricted in its occurrence, being found only in a waterfall and a deep area of an isothermal spring. (Geiger-FRC)
W83-01322

DENSITY-DRIVEN INTERSTITIAL WATER MOTION IN SEDIMENTS,

Alaska Univ., Fairbanks. Inst. of Marine Science.
D. L. Musgrave, and W. S. Reeburgh.
Nature (London), Vol 299, No 5881, p 331-334, September, 1982. 1 Fig, 20 Ref.

Descriptors: *Bottom currents, *Interstitial water, *Sediments, Bottom sediments, Sediment transport, Rayleigh number, Nusselt number, Mixing, Lakes, *Ontario, Experimental Lakes Area.

Temperature-time series measurements for a freshwater lake undergoing autumn cooling were examined. These are the first in situ observations of heat transport due to motion of interstitial waters over periods of less than 1 hour. Density, calculated from temperature, decreased with depth at the time and place that this motion occurred. Three probes were placed in the sediments of Lake 227 of the Experimental Lakes Area, Ontario, Canada, at water depths of 0.75, 1.25, and 1.75 m. These sediments have high, nearly constant porosity (0.85) and organic content. The probes were in place from mid to late October 1979 in anticipation of bottom-water density increases due to autumn cooling. It is suggested that the convecting layer, beneath a shallow stable layer, caused the observed fluctuations in some manner whose details have been examined theoretically. The increase in heat transport due to convection is quantified by the Nusselt number, which is the ratio of heat flux across a convecting layer to the heat flux across the same layer, assuming purely diffusive transport. Near the critical Rayleigh number the Nusselt number is just above 1. In Lake 227 the Rayleigh number continues to grow with time until the convecting layer intersects the impermeable rock below the sediments at 10 m. (Baker-FRC)
W83-01372

HIGH ABUNDANCE OF ALGAL 24-ETHYLCHOLESTEROL IN ANTARCTIC LAKE SEDIMENT,
Tokyo Metropolitan Univ. (Japan). Dept. of Chemistry.
G. Matsumoto, T. Torii, and T. Hanya.
Nature (London), Vol 299, No 5877, p 52-54, September, 1982. 1 Fig, 1 Tab, 35 Ref.

Descriptors: *Lake sediments, *Polar regions, *Sterols, Chemical analysis, Bottom sediments, *Antarctica, Algae, Cyanophyta, Chlorophyta, Phormidium.

The first analyses of sterols in Antarctic lake sediments are reported. These sediments were found to contain high abundances of 24-ethylcholesterol. This was the most prominent sterol in some soils and water samples from the dry valley areas as well. There are at least three possible sources for these unusual distributions of sterols: an input of aeolian dust, glacial erosion of sedimentary rocks, or biological sources such as bacteria, fungi, blue-green and green algae, and mosses found in the areas. Analytical studies revealed that 24-ethylcholesterol is the major sterol in epibenthic algae which are widely distributed in the area. Therefore algae, including green and blue-green algae, especially Phormidium spp., are important sources of 24-ethylcholesterol in Antarctic dry valley lake sediments. (Baker-FRC)
W83-01373

2I. Water In Plants

RESPONSES TO WATER STRESS IN WHEAT AND RELATED WILD SPECIES,
Agricultural Research Organization, Bet-Dagan (Israel). Inst. of Soils and Water.
For primary bibliographic entry see Field 3F.
W83-01145

EFFECTS OF ARTIFICIAL CONIFER FOLIAGE ON COLLECTION OF PRECIPITATION AND NUTRIENTS IN COASTAL BRITISH COLUMBIA,
Toronto Univ. (Ontario). Dept. of Botany.
J. B. DeCatanzaro, and D. Binkley.
Canadian Journal of Forest Research, Vol 11, No 2, p 457-458, 1981. 1 Tab, 5 Ref.

Descriptors: *Nutrients, *Moisture density, *Forests, *British Columbia, Canada, Cycling nutrients, Ecosystems, Condensation, Precipitation, Calcium, Potassium, Ammonium, Nitrate, Sulfate, Impaction, Aerosols, Augmentation.

The occurrence of moisture condensation and aerosol impaction in coastal British Columbia forests was investigated using artificial Douglas-fir foliage. Differences in these phenomena related to elevation were also sought. The presence of artificial foliage significantly increased both water and nutrient collections. Elevation accounted for significant differences in volume only. The presence of artificial foliage increased water volumes by 6% on the upper and 8% on the lower sites. The increase in nutrient content in collectors under artificial foliage varied from 23 to 143%. (Baker-FRC)
W83-01218

CANOPY AIR TEMPERATURES AND EVAPOTRANSPIRATION FROM IRRIGATED AND STRESSED SOYBEANS,
Science and Education Administration, Morris, MN.
For primary bibliographic entry see Field 2D.
W83-01313

IRRIGATION FOR CROPS IN A SUB-HUMID ENVIRONMENT, II. THE WATER REQUIREMENTS OF SOYBEANS,
University of New England, Armidale (Australia). Dept. of Agronomy and Soil Science.
W. K. Mason, G. A. Constable, and R. C. G. Smith.
Irrigation Science, Vol. 2, No. 1, p 13-22, 1980. 5 Fig, 2 Tab, 18 Ref.

Descriptors: *Irrigation patterns, *Crop production, *Water requirements, Irrigation requirements, Crop yield, *Soybeans, Farming, Evaporation, Soil water, Water supply.

An understanding of soybean water requirements and patterns of soil water extraction was sought. The water use of two soybeans cultivate (Bragg and Ruse) was measured over three seasons for a range of irrigation treatments. The seasonal totals of plant and soil evaporation ranged from 450 to 750 mm or from 36 to 64% of class A pan evaporation for the same period. Both cultivars extracted approximately 60% of the total extractable soil water in the top 1.2 m of soil before actual evaporation dropped below potential evaporation. Up to this point the ratio between the actual evaporation and class A pan evaporation averaged 0.8. Ruse used water at a faster rate than Bragg, but Ruse was not as effective in extracting the deep (below 1.0 m) soil water as was Bragg. Water use efficiency showed a small but general increase with decreasing irrigation water application. Runoff losses varied from zero for non-irrigated Ruse in 1977/78 to 352 mm for frequently irrigated Bragg in 1976/77, generally with the number of irrigations. (Baker-FRC)
W83-01314

2J. Erosion and Sedimentation

STOCHASTIC PREDICTIONS OF SEDIMENT YIELDS FROM SMALL COASTAL WATERSHEDS IN OREGON, U.S.A.,
Oregon State Univ., Corvallis. Dept. of Electrical and Computer Engineering.
J. VanSickle.
Journal of Hydrology, Vol 56, No 2/4, p 309-323, April, 1982. 4 Fig, 3 Tab, 23 Ref.

Descriptors: *Sediment yield, *Stochastic process, Runoff, *Small watersheds, Watersheds, Model studies, *Oregon, *Sediment transport, Suspended sediments.

A simple stochastic model of sediment yield is applied to data from two small Oregon coast range watersheds, Flynn Creek and Needle Branch. In this region nearly all sediment is transported during brief, distinct runoff events, especially in watersheds impacted by logging. To generate sequences of sediment yield events the model combines a runoff event frequency analysis, an event-generating process, and an empirical relationship between sediment yield and discharge. Annual sediment yields are obtained by adding the yields from individual events. The observed annual yields appear to be less variable than predicted from random sums of individual storm event yields. These discrepancies are likely a result of controls by sediment sources not included in the model. During dry years sediment accumulated in channels, and small runoff events carried greater-than-predicted loads. In years with larger runoff events observed yields were less than predicted because of flushing during the first large event. The model used here can successfully synthesize reliable long-term sediment yield distributions as long as several years of sediment data are available and sediment supplies and yields are relatively stationary. (Cassar-FRC)
W83-01053

SEDIMENTATION IN AN ARTIFICIAL LAKE - LAKE MATAHINA, BAY OF PLENTY,
Waikato Univ., Hamilton (New Zealand). Dept. of Earth Sciences.
C. J. Phillips, and C. S. Nelson.
New Zealand Journal of Marine and Freshwater Research, Vol 15, No 4, p 459-473, 1981. 13 Fig, 2 Tab, 27 Ref.

Descriptors: *Sedimentation, *Lakes, Lake Matahina, Artificial lakes, Sediment, *Lake sediments, Bottom sediments, Fluvial sediments, Catchments, Basins, *New Zealand.

Lake Matahina is a gorge-type reservoir with a maximum depth of 50 meters, a relative depth of 2.8%, and an annually fluctuating water level of only 0.5-0.75 meters. Upper reaches of the lake are shallow with a sinuous channel constricted by a narrow ignimbrite gorge. The lake appears to be a warm monomictic lake. The lake stratifies in summer and although a winter profile was not obtained, it is likely that it overturns and becomes homothermous for at least part of this season. The texture and composition of surficial and sub-bottom sediments reflect the interactions between supply of sediment from 2 major source lithologies - greywackes in the east and, more importantly, acid volcanics of both flow (ignimbrites) and particularly air-fall (tephras) origin in the west - and the influence of the inflowing Rangitaiki River upon water circulation and sediment dispersion within the lake. Three major proximal to distal lacustrine subenvironments occur: fluvial, deltaic, and basinal. Fluvial sediments occur in the upper reaches of the lake in depths of less than 3 meters and are lithic dominated, gravel-sand mixtures deposited from bed load in ephemeral channel and bar deposits. Deltaic sediments accumulate where the lake suddenly deepens from 3 to 20 meters. Basinal sediments occur deeper than 20 meters and are glassy-argillaceous silt-clay mixtures fed mainly by river plume dispersion of suspended sediment in overflows, interflows, and underflows. Sedimentation rates at the dam are about 2 cm/year. Fine sand layers in muds of basinal cores are probably deposited from density or underflow currents generated during river flooding, flowing the length of the lake. (Baker-FRC)
W83-01084

DYNAMICS OF THE FORESHORE OF A LARGE AGGRADATIONAL FEATURE IN THE NORTHWESTERN BLACK SEA,
Kiev State Univ. (USSR). Inst. of Fluid Mechanics.
V. V. Khomitskii, Yu. N. Sokol'nikov, A. V. Kalinovskii, and E. S. Tsaitts.
Water Resources, Vol 8, No 5, p 498-503, September-October, 1981. 3 Fig, 4 Ref. Translated from Vodnye Resursy, No 5, p 63-70, September-October, 1981.

Descriptors: *Spatial distribution, *Sediment transport, Estuaries, *Shores, *Aggradation, Dynamics, Morphology, *Sediment load, *Lithologic logs, Water management, Coasts, Sedimentation, Bathymetry, Erosion, Sediment distribution, *Black Sea.

To solve problems of assessing the spatial development of aggradational features and predicting possible changes in the natural regime of sediment movement for the construction of water management structures, an on-site investigation of the morpho- and lithodynamics of the body of the aggradational features should be organized. As an example of such a study, a bathymetric survey was carried out annually at the sounding sites for the seaside perimeter of the Kinburn spit to the 6.0-meter isobath and within the 4.0-meter isobath. More frequent soundings were taken at certain sections in 1976. Sediment load was calculated by the wind-wave energy method, and the longshore transport of sediments was calculated for five sections of the sea and liman perimeters of the Kinburn spit with uniform shoreline directions. Results showed that the transformation of the shore of the spit is closely related to the amount and direction of the longshore movement of sediments. Deformations of the contour of the spit on the liman side occurred analogously to the distribution of the sediment load. In the case of the Dnepr-Bug liman, the spit has stable configurations on the liman side, and the sea perimeter has shore deformations occurring in a cyclic character when the changes of the waterline on the profiles have an alternating character and the absolute value of recession is no more than 0.5 meters/yr. (Geiger-FRC)
W83-01095

AN IMPROVED METHOD OF DETERMINING SEDIMENTATION RATES BY THE USE OF ARTIFICIAL RADIONUCLIDES,
Lancaster Univ., Bailrigg (England). Dept. of Environment Sciences.
D. A. Stanners, and S. R. Aston.
Estuarine, Coastal and Shelf Science, Vol 13, No 1, p 101-106, July, 1981. 3 Fig, 5 Ref.

Descriptors: *Sedimentation rates, *Estuaries, *Regression analysis, Ravenglass Estuary, *England, Mathematical studies, Sediments, Estuarine environment, Sedimentation, *Radionuclides, Irish Sea, Spectroscopy.

The use of radionuclide activity profiles to determine estuarine sedimentation rates has been improved by the application of statistical tests. Sediment cores were taken by inserting polyethylene core liners directly into intertidal deposits. The cores were extruded, segmented, and the subsamples dried at 60 C. The radionuclide activities in the sediments were determined by gamma spectroscopy. A method is outlined for the use of regression analysis and test of best fit for applying nuclear waste discharge data to the quantitative determination of net sedimentation rates. The methodology also allows the measurement of apparent diffusion of radionuclides in sediments and the lag time from discharge point to sediment deposition. The technique was applied to sediment cores from the Ravenglass estuary near the Windscale, England, nuclear fuel reprocessing facility. The range of sedimentation rates was 0.25 to 71 mm per year, with a lag time of 1.5 year for radiocesium. (Baker-FRC)
W83-01153

DYNAMICS OF MUD (SLICK) AND SUSPENDED MATTER IN ESTUARIES. APPLICABILITY OF BY-PRODUCTS OF SURVEYS OF GERMAN COASTAL AGENCIES IN VIEW OF REQUIREMENTS FOR FUTURE NEEDS,
Deutsches Hydrographisches Inst., Hamburg (Germany, F.R.).
J. Hulsemann.
Deutsche Hydrographische Zeitschrift, Vol 35, No 2, p 82-89, 1982. 44 Ref.

Descriptors: *Dredging, *Suspended sediments, *Mud, *Sedimentation, *Estuaries, *Reviews, Sediment transport, *Germany, Fluid flow, Water circulation, Turbidity, Research priorities.

The state of the art of transport and sedimentation of fine-grained sediments as applied to the problem of dredging estuarine mud in Germany is summarized. Present sediment transport data are insufficient for use in management of navigation channels in estuaries because there is a wide discrepancy between theoretical and observed conditions. However, the water circulation in estuaries is reasonable well understood. A turbidity maximum occurs at the landwardly inclined sald water wedge. At this point sedimentation is increased. In German estuaries maintained by dredging, bed material the brackish water zone is characterized by sand and salt, whereas the fine-grained fraction collects at the side and banks of the channels. These fine sediments often lead to mud deposits in side arms of rivers, inner reaches of river bends, and harbors with mouths of branches. Some recent investigations revealed the existence of a fluid mud layer (70 g per liter suspended matter) near the bottom of the turbidity maximum region in the Weser Estuary. This relatively immobile layer is associated with spring and neap tides in high energy estuaries and with storms and dreding activities in low energy estuaries. The fluid mud layer erodes at the surface before the entire layer moves and is affected by shallow water waves. (Cassar-FRC)
W83-01161

EROSION, REDEPOSITION, AND DELIVERY OF SEDIMENT TO MIDWESTERN STREAMS,
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 4D.
W83-01203

THE DYNAMICS OF A RIVER BEND: A STUDY IN FLOW AND SEDIMENTARY PROCESSES,
State Univ. of New York at Binghamton. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2E.
W83-01249

210PB GEOCHRONOLOGY AND TRACE METAL CONCENTRATIONS OF SEDIMENTS FROM UPPER KLAMATH LAKE AND LAKE EUWANA, OREGON,
Geological Survey, Corpus Christi, TX.
E. A. Martin, and C. A. Rice.
Northwest Science, Vol 55, No 4, p 269-280, November, 1981. 2 Fig, 2 Tab, 34 Ref.

Descriptors: *Lake sediments, *Sedimentation rates, *Bottom sediments, Lakes, Sediments, Metals, Copper, Cadmium, Chromium, Iron, Lead, Manganese, Zinc, Mixing, Upper Klamath Lake, Lake Euwana, *Oregon.

In response to citizen complaints of sediment deposition, rates of sedimentation were calculated from the analyses of 210Pb activities in cores from two shallow lakes whose mean depths are 2.4 m, Upper Klamath Lake and Lake Euwana in Oregon. The studies indicated that the lakes are filling at approximately 3.0 mm/year. Average sedimentation rates for compaction-corrected cores range from 0.9 mm/year to 8.5 mm/yr or from 0.03 g/sq cm/yr to 0.48 g/sq cm/yr, respectively. Plots of excess 210Pb activity versus depth show a mixing layer due to biological activity and other physical mixing that ranges in thickness from 5 to 20 cm and that is found below the sediment-water interface at all coring locations. Trace metal analyses performed to establish baseline levels of selected elements show very low concentrations of all metals measured in cores from Upper Klamath Lake when compared with concentrations of these metals found in other North American lacustrine environments. The sediments from the lakes, except for a few pumice layers, are relatively homogeneous in texture and in moisture content, 81-92%. (Baker-FRC)
W83-01252

SEDIMENT FANS AND SEDIMENT FLOWS GENERATED BY SNOWMELT: OBSERVATIONS AT AUSTERDALSISEN, NORWAY,
Victoria Univ. of Manchester (England). Dept. of Geography.
W. H. Theakstone.
Journal of Geology, Vol, 90, No 5, p 583--588, 1982. 3 fig, 1 Tab, 22 Ref.

Descriptors: *Sediments, *Alluvial fans, *Snowmelt, Sedimentary structures, Fluvial sediments, Sediment transport, *Norway, Austerdalsisen, Erosion, Viscosity, Sands, Fluid mechanics, Hydrodynamics.

Sediments in the Austerdalsisen basin, Norway, are re-worked annually during the short snowmelt period. In the last 10-15 years several fans have been constructed, largely by sediment flows. Sediment-water mixtures move downslope under the influence of gravity. The viscosity of the flows varies considerably, and a single flow may change as a result of water or sediment loss. Fan characteristics reflect the nature of the sediments, the mechanics of flow, modes of deposition, and the annual periodicity of activity. The composition of most fans is dominated by grains of sand-size, which made up the bulk of the original succession in the Austerdalsisen basin. (Baker-FRC)
W83-01254

2K. Chemical Processes

GEOCHEMICAL DENUDATION RATES AND SOLUTE TRANSPORT MECHANISMS IN A MARITIME TEMPERATE GLACIER BASIN,
Toronto Univ. (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 2C.
W83-01109

FLUID-MINERAL EQUILIBRIA IN A HYDROTHERMAL SYSTEM, ROOSEVELT HOT SPRINGS, UTAH,
Utah Univ. Research Inst., Salt Lake City. Earth Science Lab.
R. M. Capuano, and D. R. Cole.
Geochimica et Cosmochimica Acta, Vol 46, No 8, p 1353-1364, August, 1982. 7 Fig, 5 Tab, 53 Ref.

Descriptors: *Geothermal studies, *Equilibrium, *Mineral springs, *Hot springs, Springs, Wells, Chemical composition, Chemical reactions, Roosevelt Hot Springs, *Utah, Groundwater reservoirs.

An investigation of fluids and drill cuttings from the Roosevelt Hot Springs hydrothermal system, Utah, indicated a common reservoir source (temperature 288 + or - 10 C) for the four types of water present: deep circulating thermal fluid from producing wells, hot water from nonproducing wells, recent discharge from the Roosevelt seep, and water from the now dry Roosevelt Hot Spring. The deep fluid was sodium chloride in character, with 9700 ppm dissolved solids, pH of 6.0 , and gas partial pressures (in atmospheres) of oxygen ranging from 10 to the minus 32nd power to 10 to the minus 35th power; carbon dioxide, 11; hydrogen sulfide, 0.020; and methane, 0.001. Water from producing wells was distinctly different from water in nonproducing wells. Nonproducing wells had lower temperatures and concentrations of Na, K, F, Cl, and total dissolved solids and higher concentrations of Ca, Mg, Fe, sulfate, and bicarbonate. Minerals theoretically in equilibrium with the deep reservoir fluid at > 240 C were sericite, K-feldspar, quartz, chalcedony, hematite, magnetite, and pyrite. This group was similar to that in equilibrium in deep parts of producing wells. Epidote, anhydrite, chlorite, and calcite were not in equilibrium with the reservoir fluid. Results suggest that the reservoir fluid at Roosevelt Hot Springs has not significantly changed in the recent past. (Cassar-FRC)
W83-01142

CHEMICAL OSMOSIS, REVERSE CHEMICAL OSMOSIS, AND THE ORIGIN OF SUBSURFACE BRINES,
Illinois Univ. at Urbana Champaign. Dept. of Geology.
D. L. Graf.
Geochimica et Cosmochimica Acta, Vol. 46, No. 8, p 1431-1440, August, 1982. 6 Fig, 149 Ref.

Descriptors: *Osmotic pressure, *Brines, *Geochemistry, *Reverse osmosis, *Osmosis, *Chemical osmosis, Overpressuring, Aquathermal pressuring, Shales, Membrane processes, Sedimentary basins,

Seawater, Minerals, Tectonics, Deposition, Dissolved solids, Ion exchange, Geothermal studies, Diagenesis, Saline water, Chlorides, Sulfates, Calcium, Magnesium, Chemical precipitation, Chemical reactions, Hydrostatic pressure, Geologic fractures, Geohydrology, Pore pressure, Recharge, Gypsum, Dehydration.

Calculations using density and osmotic coefficients for NaCl-H2O indicate that overpressuring can overcome chemical osmosis and produce reverse chemical osmosis in sedimentary sequences. The most common mechanism for generating overpressuring is rapid deposition of fine-grained minerals. Other mechanisms are dehydration of gypsum (for brief periods at shallow depths), water evolation from conversion of smectite to illite (at greater depths), and tectonic compression and aquathermal pressuring (in sediment layers older than Cretaceous). Aquathermal pressuring may be of major importance in geothermal areas where low permeability seals block normal heat flow and of significant importance in areas with normal geothermal gradients where shales inhibit normal fluid flow. Evidence for membrane concentration of seawater solutes to form present-day brines includes: (1) the correlation of delta- D values of water molecules or pore fluid with those of local meteoric water, and (2) the need for major sources of Mg(++) and chloride in apparently evaporite-free basins. Where dissolution of halite is a major source of dissolved solids, reverse chemical osmosis operates to leak relatively dilute solutions from overpressured regions. Concentrated chloride brines rich in Ca(++) are effectively produced by reactin of Mg(++) with limestone to form dolomite. This reaction decreases Mg(++) concentrations, increases Ca(++) concentrations, and decreases sulfate and carbonate by precipitation of CaCO3 and CaSO4. (Cassar-FRC)
W83-01143

STATISTICAL ANALYSIS OF ESTUARINE PROFILES: APPLICATION TO MANGANESE AND AMMONIUM IN THE TAMAR ESTUARY,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
For primary bibliographic entry see Field 2L.
W83-01154

GROUND WATER GEOCHEMISTRY OF 228RA, 226RA, AND 222RN,
South Carolina Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 5A.
W83-01157

INTERPRETATION OF PH AND EH TRENDS IN A FLUVIAL-SAND AQUIFER SYSTEM,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
R. E. Jackson, and R. J. Patterson.
Water Resources Research, Vol 18, No 4, p 1255-1268, August, 1982. 10 Fig, 6 Tab, 31 Ref.

Descriptors: *Groundwater recharge, *Aquifer characteristics, Sand, *Fluvial sediments, Acidity, Hydrogeology, Chemical reactions, Carbonates, *Hydrogen ion concentration, *Oxidation-reduction potential.

The hygrogeochemical processes affecting pH and Eh in a fluvial-sand aquifer composed primarily of alumino-silicate minerals are discussed. It is shown that the measured pH reflects hydrogen ion uptake, biotite weathering, and carbonate mineral dissolution. The Eh values are interpreted as being the result of the reduction of initially oxidized groundwater by DOC and/or Fe(II), with subsequent reactions involving sulfate reduction and possibly denitrification. Acid neutralization capacity measurements and X ray diffractograms suggest that acid precipitation recharging the aquifer undergoes a two-step neutralization process. The first step involves reactions with the surfaces of mineral grains, mainly with plagioclase and biotite, and the second step involves an irreversible neutralization, with biotite alteration to vermiculite and carbonate mineral dissociation. Because of the problems of using Pt electrodes in groundwaters it is recommended that Eh measurements be supplemented with dissolved oxygen and sulfide measurements. (Baker-FRC)
W83-01201

WATERSHEDS IN MUSKEG TERRAIN. 1. THE CHEMISTRY OF WATER SYSTEMS,
Alberta Univ., Edmonton. Dept. of Geology.
F. W. Schwartz, and W. A. Milne-Home.
Journal of Hydrology, Vol 57, No 3/4, p 267-290, June, 1982. 15 Fig, 4 Tab, 21 Ref.

Descriptors: *Muskeg, *Chemical composition, *Streamflow, Geochemistry, Geohydrology, Surface water, Groundwater, Runoff, Hartley Creek, Muskeg River, *Alberta, Water quality, Snowmelt, Baseflow, Watersheds, Wetlands, Surface-groundwater relations, Seasonal variation, Glacial drift.

The chemistry of water systems in the Muskeg River basin, Alberta, with emphasis on Hartley Creek, was studied in detail over 3 years. Major ion compositions differ in stream water, groundwater, muskeg water, and surface runoff. Most of the waters are of the Ca-Mg-bicarbonate type. Groundwaters in the glacial drift have higher levels of Ca, Mg, and bicarbonate than muskeg and surface runoff. This is a result of dissolution of carbonates. Groundwaters from bedrock are higher in Na, sulfates, and chlorides than glacial drift groundwaters. Stream water has a chemical composition ranging between that of groundwater aand muskeg/runoff. Streams are at baseflow in winter when groundwter is the only source of streamflow. During this time the chemical compositions of stream water and groundwater are nearly identical. After spring snowmelt, muskeg is an important contributor to streamflow, which assumes a chemical composition similar to that of the standing muskeg water. During snowmelt and storm runoff periods stream water is further diluted from inputs of precipitation and surface runoff. (Cassar-FRC)
W83-01206

CHEMICAL INTERACTIONS BETWEEN FOREST SOILS AND ACIDIC PRECIPITATION DURING A DORMANT SEASON ON WILDCAT RUN WATERSHED IN SOUTHWESTERN PENNSYLVANIA,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
R. T. Leibfried.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139675, Price codes: A05 in paper copy, A01 in microfiche. Master of Science Thesis in Forest Resources, August 1982. 86 p. 13 Tab, 17 Fig., Append. OWRT B-117-PA (1), 14-34-0001-0277.

Descriptors: *Forest soils, Precipitation, *Soil water, *Water quality, Snowmelt, Rainfall, Soil horizons, Aluminum leaching, *Pennsylvania, Hydrogen ion concentration, *Acidic precipitation, *Chemical interactions, Soil leachate, Wildcat Run Watershed, Buffer, Infiltrating water, Soil series, Percolate chemistry, Dormant season.

In order to assess the chemical interactions between forest soil and acidic precipitation, water samples were collected at the soil surface and beneath organic and mineral soil horizons on Wildcat Run Watershed in southwestern Pennsylvania during the 1980-81 dormant season. Leachate samples were collected from the three major soil series on the watershed (Ernest, Calvin, and Dekalb) using zero-tension pan lysimeters to determine chemical changes produced by the different soil horizons. Mean pH was 4.0, 3.9, and 4.4 for surface snowmelt and rain, organic soil leachate, and mineral soil leachate, respectively; indicating a significant retention of H+ in -1 the mineral soil horizons. Mean aluminum concentration was 0.44, 1.03, and 3.59 mg.l at the same three collection depths. Mineral soil leachate pH was nearly identical to the minimum pH of 4.4 found in poorly buffered streams during peak run-off from snowmelt and winter rain events. At a pH value near 4.4 in the poorly buffered streams the maximum aluminum concentration reached 1.5 mg.l-1 which was less than the concentrations found in the mineral soil leachate but well above the lethal limit for trout. Collection depth was the most important factor affecting percolate chemistry while soil series, size-of-event, and precipitation-type were of lesser importance.
W83-01236

CHEMICAL MODEL OF CASPIAN SEA WATER,
Akademiya Nauk Azerbaidzhanskoi SSR, Baku.
B. A. Balakishiyeva, and T. N. Rashidova.
Geochemistry International, Vol 17 No 2, p 133-147, 1980. 9 Tab, 32 Ref.

Descriptors: *Chemical composition, *Ions, *Seawater, *Caspian Sea, Thermodynamics, Metals, Temperature effects, Hydrogen ion concentration, Cations, Anions, Alkali metals, Alkaline earth metals, Heavy metals, Trace metals, Ionic strength, Mixing.

Quantitative relationships between the forms of elements in the Caspian Sea were calculated on the basis of thermodynamics for surface (25 C) and bottom (5 C) conditions, for pH of 7.7, 8.0, 8.2, and 8.4, and for Eh of 0.4 and 0.44. Forms of occurrence of elements in rivers flowing into the Caspian Sea were also calculated for pH 8, Eh 0.44, and 25 C. An increase in ionic strength of the water decreased the proportion of Na, Ca, K, Mg, sulfate, and bicarbonate in the free form and increased the proportion of their complexes. At the higher temperatures, there was a grater degree of dissociation in the following: silicic, phosphoric, boric, chromic, selenic, carbonic, and hydrosulfuric acids; carbonates of Mn and Ni; and hydroxides of Cu, Pb, Be, and Al. Increases in Eh sharply increased the proportion of selenate and chromate forms over other forms of combined Se and Cr, especially at low pH and low temperature. A pH change over the range of this study did not affect the behavior of alkali and alkaline earth metals and Zn, Fe, Al, Ga, Zr, Sn, and Be. However, an increase in pH increased the carbonate forms of Mn and Ni, the hydroxides of cu, Pb, and Al, the percentage of uranyl nitrate complexes, and the degree of dissociation of silicic, phosphoric, chromic, boric, selenic, and hydrosulfuric acids. (Cassar-FRC)
W83-01251

HIGH ABUNDANCE OF ALGAL 24-ETHYL-CHOLESTEROL IN ANTARCTIC LAKE SEDIMENT,
Tokyo Metropolitan Univ. (Japan). Dept. of Chemistry.
For primary bibliographic entry see Field 2H.
W83-01373

MAJOR ION CHEMISTRY OF SOME LARGE CHINESE RIVERS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
H. Ming-hui, R. F. Stallard, and J. M. Edmond.
Nature (London), Vol 298, No 5874, p 550-553, August, 1982. 2 Fig, 3 Tab, 13 Ref.

Descriptors: *Rivers, *Chemical properties, *Ions, Sulfates, Carbonates, Chiang Jiang River, Quiantang River, *China, Huang He River, Chlorides, Dissolved solids.

Samples were taken from the main channel of the Chiang Jiang at Chungking, above the Gorges, and at Wuhan in the central part of the flood plain. The tributaries are typical carbonate rivers, with alkalinity accounting for over half of the anion balance. Calcium and magnesium are the major cations. In both rivers sulfate is substantially higher than chloride, indicating a major contribution from the dissolution of gypsum and minor halite. The Quiantang, sampled at Hangzhou, is an extreme example of carbonate weathering. Calcium and alkalinity account for over 85% of the cation and anion balances. Thus the chemistry of the major rivers of China is dominated by the weathering of carbonates and evaporites in varying proportions. The effects of the degradation of aluminosilicates are nowhere pronounced. With the exception of

the Huang He the major rivers are free from large scale hydrological development. (Baker-FRC)
W83-01374

VARIATION OF TRACE ELEMENT CONCENTRATION IN RAINWATER WITH RAINFALL RATE AND RAINFALL AMOUNT,
Bhabha Atomic Research Center, Bombay (India). Air Monitoring Section.
For primary bibliographic entry see Field 5A.
W83-01379

2L. Estuaries

AN ASSESSMENT OF THE IMPORTANCE OF SOME PARAMETERS FOR SEAWATER INTRUSION IN AQUIFERS AND A COMPARISON OF DISPERSIVE AND SHARP-INTERFACE MODELLING APPROACHES,
James Cook Univ. of North Queensland, Townsville (Australia).
For primary bibliographic entry see Field 2F.
W83-01051

LOW-FREQUENCY VARIATIONS IN SEA LEVEL AND CURRENTS IN SOUTH SAN FRANCISCO BAY,
Geological Survey, Menlo Park, CA.
R. A. Walters.
Journal of Physical Oceanography, Vol 12, No 7, p 658-668, July, 1982. 8 Fig, 3 Tab, 17 Ref.

Descriptors: *Sea level, *Currents, *Tidal effects, Estuaries, San Francisco Bay, Water level, Water currents, Wind-driven currents, Bays, Variability, Wind, *California.

Sea level and current meter data for south San Francisco Bay, a drowned river valley, were analyzed. The low-frequency variations in sea level are dominated by non-local coastal forcing. Locally generated wind setup, especially from westerly to northerly winds, has a small effect on sea level. The low-frequency variation in currents is dominated by a tidally forced residual current and a wind-driven current. The tidally forced current accounts for the long-term circulation pattern and is perturbed by 2-3 day meteorological events. These conditions apply to late spring and summer conditions, not considering storm events. However, winter storms may have significant effects. (Cassar-FRC)
W83-01057

LABORATORY INVESTIGATION OF THE STRUCTURE OF THE FLOW AND BOTTOM FEATURES IN RIVER MOUTH REGIONS,
Moscow State Univ. (USSR). Hdrophysical Lab.
For primary bibliographic entry see Field 2E.
W83-01099

STRUCTURAL ANALYSIS OF FOULING COMMUNITY DEVELOPMENT IN THE DAMARISCOTTA RIVER ESTUARY, MAINE,
EG and G Environmental Consultants, Inc., Waltham, MA.
B. Field.
Journal of Experimental Marine Biology and Ecology, Vol 57, No 1, p 25-33, 1982. 2 Fig, 3 Tab, 33 Ref.

Descriptors: *Fouling, *Invertebrates, Estuaries, *Damariscotta River Estuary, *Maine, Species diversity, Species composition, Succession, Barnacles, Bryozoans, Tunicates, Hydroids, Regression analysis, Cluster analysis.

The development of a marine fouling community was followed on asbestos plates submerged in Dodge Cove, Damariscotta Estuary, Maine, from August 1976 to January 1978. The fouling community was subdivided into primary, which attaches directly to the substrate, and secondary, which lives on and among the primary fouling assemblage. Date were analyzed using cluster analysis. Multiple regression was used to relate the structure of the secondary fouling community to the biological and abiotic factors affecting it. Primary colonizers such as bryozoans (encrusters and branchers), tunicated (fleshing organisms), and hydroids (branchers, bivalves, polychaetes, and barnacles) altered the substrate and made it available for other species unable to settle on a smooth surface. Many of the colonizers trap sediment inviting to infaunal species. Both assemblages showed a general increase in number and diversity of species with time; dominance decreased with time. The number and diversity of secondary foulers was dependent on several factors, given in decreasing order of importance: branchers, barnacles, time, temperature, and encrusters. (Cassar-FRC)
W83-01117

THE SPECIATION OF IONS IN TIBER RIVER ESTUARY WATERS,
Miami Univ., FL.
For primary bibliographic entry see Field 5B.
W83-01118

DEEP WATER RENEWALS AND OXYGEN CONSUMPTION IN AN ALASKAN FJORD,
Alaska Univ., Fairbanks. Inst. of Marine Science.
D. T. Heggie, and D. C. Burrell.
Estuarine, Coastal and Shelf Science, Vol 13, No 1, p 83-99, July, 1981, 12 Fig, 3 Tab, 16 Ref.

Descriptors: *Deep water, *Oxygen requirements, *Fjords, *Alaska, Resurrection Bay, Bays, Seasonal variation, Continental shelf, Phytoplankton, Productivity, Primary Productivity, Oxidation, Bottom water.

The residence time of waters in estuaries is an important control on the flux of river borne matter between the estuary and the open ocean. Water renewal times and oxygen consumption were analyzed in Resurrection Bay, a single-silled fjord on the south central Alaskan coastline. The Bay is about 30 km long, and 6-8 km wide. The weather in the area is primarily controlled by that over the adjacent Gulf of Alaska, but mountains on either side in excess of 1000 m tend to channel local winds axially. Summer winds are southerly, while the reverse holds through the winter. Freshwater runoff from the Resurrection River occurs principally between July and September, and monthly mean discharge rates of about 2000 cubic m/sec are estimated at about 2% of the tidal prism; the latter is less than 5% of the volume of the fjord. Deep and bottom waters are generally renewed annually by inflows of dense water during summer and fall. Renewals are related to seasonal variations in the density of continental shelf source water. Density maxima in summer results from a relaxation of a winter coastal downwelling condition. Deep water renewals may begin as early as April-May and are complete by September-October. During 1973 renewals were sufficient to replace the topographic basin volume 3-4 times over, but were less by half during the same period in 1974. Oxygen consumption rates in the bottom 100 m of the water column were highest during fall and early winter following summer phytoplankton production and were less during late winter and spring. Consumption rates 10 m above the sediments were about double the deep basin estimates, and about 30% of the in situ annual primary production was oxidized in the fjord bottom waters and underlying surface sediments. (Baker-FRC)
W83-01119

LABORATORY SIMULATION OF CHEMICAL PROCESSES INDUCED BY ESTUARINE MIXING: THE BEHAVIOUR OF IRON AND PHOSPHATE IN ESTUARIES,
Institute for Marine Environmental Research, Plymouth (England).
A. J. Bale, and A. W. Morris.
Estuarine, Coastal and Shelf Science, Vol 13, No 1, p 1-10, July, 1981. 3 Fig, 2 Tab, 33 Ref.

Descriptors: *Estuarine environment, *Chemical reactions, *Mixing, *Iron, *Phosphate, Simulation, Chemical composition, Estuaries, Laboratory Studies.

Realistic reproductions of the well characterized behavior of iron and phosphate during estuarine mixing have been achieved in the laboratory using a simulator consisting of a series of five tank reactors, each well stirred. Each reactor is a 3 liter borosilicate glass beaker modified by the inclusion of a side-arm. Continuous monitoring of chemical components in the tank reactors is obtained using ion-specific electrodes. Stationary state mixing was developed between freshwater and estuarine waters of salinity about 3 o/oo at temperatures of 9, 14, and 23 C. The resultant reactive phosphate and total iron concentrations passing a 0.45-microm pore-size membrane filter for each reactor were compared. Significant removal of both reactive phosphate and total iron passing the filter occurred throughout the mixing series, although the percentage loss of iron appeared to have been independent of temperature. Reactive phosphate loss was accentuated by increasing temperature. Following the establishment of mixing equilibria and measurements of reactive phosphate and total iron concentrations, inter-reactor transfers were stopped, but stirring of each reactor was continued. Changes in the concentrations of reactive phosphate and total iron within each reactor were subsequently followed over a 24 hr period. It was found that concentrations of iron and phosphate generally remained within 5% of their starting values, and no consistent trends were evident. (Baker-FRC)
W83-01120

STABLE DENSITY FRONTS AND DINOFLAGELLATE PATCHES IN A TIDAL ESTUARY,
Washington Univ., Seattle. Coll. of Ocean and Fisheries Science.
L. S. Incze, and C. M. Yentsch.
Estuarine, Coastal and Shelf Science, Vol 13, No 5, p 547-556, November, 1981. 3 Fig, 21 Ref.

Descriptors: *Estuarine environment, *Dinoflagellates, *Density currents, *Tidewater, Plankton, Red tide, *Eutrophication, *Maine, Coastal waters.

The possibility that the observed behavior of dense surface patches of dinoflagellates in the upper estuary of the Damariscotta River in Maine could be related to changes in the vertical stability of the water during various stages of the tide was examined. Evidence presented here indicates that changes in mixing regimes which can take place over comparatively short distances can give rise to substantial differences in spatial distribution of dinoflagellates, including the species responsible for toxin in shellfish along coastlines in the western Gulf of Maine. It is noted that the sampling opportunities during these initial studies were limited. However, the development and longevity of the observed patches appeared to be critically tied to the proper phasing of a non-spring-tide series, adequate thermal and freshwater buoyancy input, and other factors favorable to these organisms. The data suggest that the development of such patches within this region of this estuary should be fairly predictable. No significant introduction of dinoflagellates to this region was apparent during these studies. It seemed that the patches resulted primarily from changes in the physical behavior of the system at a time when dinoflagellates were present, although these changes were probably coupled with some population growth of the dominant species. Both frontal types described in this study apparently provided physical conditions conducive to the accumulation of dinoflagellates within relatively confined areas, and neither seemed to favor a different dominant species. (Baker-FRC)
W83-01121

ENERGY FLOW IN THE YTHAN ESTUARY, ABERDEENSHIRE, SCOTLAND,
Port Elizabeth Univ. (South Africa). Dept. of Zoology.
D. Baird, and H. Milne.
Estuarine, Coastal and Shelf Science, Vol 13, No 4, p 455-472, October, 1981. 5 Fig, 34 Tab, 76 Ref.

Descriptors: *Estuarine environment, *Energy, *Productivity, Nutrients, Carbon, Nitrogen, Detritus, Organic matter, Ythan Estuary, *Scotland, Benthos, Algae, Phytoplankton.

A steady-state energy flow model has been constructed for the Ythan estuary. The estuary is located about 20 km north of Aberdeen and is tidal for about 8 km from the mouth. Maximum width of the estuary is 620 m at the Sleek of Tarty but averages about 300 m wide throughout its length, with a mean depth of 2.5 m at high tide. Four small tributary burns flow into the estuary, and the river presently receives about 1500 cu m of primary treated sewage per day from Ellon and Newburgh. Nutrient and particulate organic carbon flux were investigated in terms of freshwater drainage and tidal action. No rates of retention, however, could be provided. Organic C to organic N ratios of detritus vary from 1:14 to 1:200 in the water column, while this ratio is 1:8 in the sediments of the mudflats. Primary production by benthic macrophytes, benthic algae and phytoplankton amounts to 631 g C/sq m/yr, while the production for zooplankton is 0.8 g C/sq m/yr, for meiofauna 19.5 g C/sq m/yr, and for macrofauna 48.8 C/sq m/yr. The efficiency of energy transfer between the invertebrate macrofauna and vertebrate predators approximates 54.2%, which is higher than that recorded heretofore in various aquatic ecosystems. (Baker-FRC)
W83-01122

URANIUM, THORIUM AND LEAD NUCLIDES IN A DELAWARE SALT MARSH SEDIMENT,
Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 5B.
W83-01123

TIDAL EXPORT OF PARTICULATE ORGANIC MATTER FROM A NORTHERN AUSTRALIAN MANGROVE SYSTEM,
Australian Inst. of Marine Sciences., Townsville.
K. G. Boto, and J. S. Bunt.
Estuarine, Coastal and Shelf Science, Vol 13, No 3, p 247-255, September, 1981, 4 Fig, 12 Ref.

Descriptors: *Particulate matter, *Mangrove swamps, *Tidal effects, Organic matter, Chlorophyll, Adenosine triphosphate, Carbon cycle, *Australia, Estuarine environment, Litter.

Carbon and nitrogen budgets were investigated for a mangrove system in north Queensland. In this particular mangrove estuary extensive litter fall statistics are available. The mangrove forest is some 500 ha and is drained by a tidal channel approximately 6 km long and 160 m in width at the mouth. This area is a subunit of a larger mangrove forest system occupying an area of about 50 sq km. A series of tidal channels drains these forests. The only waterway with significant freshwater input is Bowen Creek. A total of at least 26 mangrove species occur in these forests. Flushing of the mangrove litter by the tides probably represents the major form of particulate carbon and nitrogen export. From the observed average litter fall rate of 2.44 g/sq m/day for this area and from the survey data which shows an area of about 400 ha inundated on an average high tide, the annual net export of litter from the basin was estimated to be 3560 metric tons, which is equivalent to a rate of 19.5 kg/ha/day. The litter is effectively removed from the system via tidal action. The effect of grazing and decomposition is minor. The nature of the microparticulate matter is described with particular reference to the variation of total organic carbon, adenosine triphosphate and chlorophyll during a tidal cycle. (Baker-FRC)
W83-01124

ACCUMULATION OF PLANT NUTRIENTS AND HEAVY METALS THROUGH SEDIMENTATION PROCESSES AND ACCRETION IN A LOUISIANA SALT MARSH,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. D. DeLaune, C. N. Reddy, and W. H. Patrick, Jr.
Estuaries, Vol 4, No 4, p 328-334, December, 1981. 1 Ffig, 5 Tab, 15 Ref.

Descriptors: *Nutrients, *Heavy metals, *Accretion, Marshes, Estuaries, *Salt marshes, Wetlands, *Louisiana, Nitrogen, Phosphorus, Organic matter, Metals, Sedimentation, Barataria Basin.

Accretion rates for some Barataria Basin, Louisiana, salt marsh sites were 1.35 cm per year in a location 7 m from a stream (streamside marsh), 0.75 cm per year at a site 45 m from the stream (inland marsh), and 1.10 cm per year in adjacent Airplane Lake. These accretion rates were approximately equal to the subsidence rates. Plant nutrients and heavy metals were deposited by sedimentation. Average concentrations of nutrients (in mg per g) were: nitrogen-streamside marsh 6.23, inland marsh 8.75, and lake 2.46; phosphorus-0.49-0.52; and organic carbon-streamside marsh 11.2, inland marsh 15.6, and lake 3.8. Average heavy metals concentrations (micrograms per g) were characteristic of pristine marshes: Fe, 13-21; Mn, 87-243; Cd, 1.7-2.0; Pb, 23-28; Cu, 13-18; and Zn, 66-81. Accumulation rates for nutrients (in g per sq m per year) for the streamside marsh, inland marsh, and lake, respectively, were: nitrogen, 21, 13.4, and 15.3; organic matter, 678, 409, and 398; and phosphorus, 1.7, 0.8, and 3.2. (Cassar-FRC)
W83-01125

RELATIONSHIPS BETWEEN ORGANICALLY BOUND CU MN IN SETTLING PARTICULATE MATTER AND BIOLOGICAL PROCESSES IN A SUBARCTIC ESTUARY,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
R. A. Feely, A. J. Chester, A. J. Paulson, and J. D. Larrance.
Estuaries, Vol 5, No 1, p 74-80, March, 1982. 2 Fig, 1 Tab, 25 Ref.

Descriptors: *Metals, *Particulate matter, *Zooplankton, Copper, Manganese, Trace metals, Heavy metals, Estuaries, Kachemak Bay, Lower Cook Inlet, *Alaska, Organic matter, Population dynamics. Phytoplankton, Primary productivity, Productivity, Organic carbon, Feces, Sedimentation.

Zooplankton fecal pellets were a major mechanism in the transfer of trace metals from the water column to the sediments in Kachemak Bay, loaded in Lower Cook Inlet, Alaska. Plankton and short-term (5-6 days) sediment trap studies were conducted in March-August 1978. Primary productivity was maximum in May and decreased throughout the summer. The concentrations of organically bound Cu and Mn in sediment trap particulate matter and the fecal pellet production increased throughout the summer to a maximum in August. The fluxes of total particulate matter and organic carbon reached a maximum in June, increasing 30% from May to June. The fluxes of organically bound Cu and Mn and fecal pellets were 200%, 360%, and 760%, respectively, higher in August than in May. Daily fluxes in August were: Cu, 85 micrograms per sq m; Mn, 1530 micrograms per sq m; and fecal pellets, 3.1 million per sq m. These results suggest that the enrichment of Cu and Mn in organic particulate matter during August was a result of bioaccumulation of these metals into fecal material. (Cassar-FRC)
W83-01126

INFLUENCE OF PH ON THE FLUORESCENCE OF DISSOLVED ORGANIC MATTER,
Nederlands Inst. voor Onderzoek der Zee, Texel. Biological Research Ems-Dollart Estuary.
R. W. P. M. Laane.
Marine Chemistry, Vol 11, No 4, p 395-401, 1982. 3 Fig, 18 Ref.

Descriptors: *Fluorescence, *Organic matter, *Hydrogen ion concentration, Estuaries, Ems-Dollart Estuary, *The Netherlands, Seasonal variation.

The influence of pH over the natural range of 7-9 was investigated during two surveys (June 1980 and March 1981) in the Ems-Dollart Estuary, the Netherlands. There was a mean increase of 16.4% in millifluorescence from pH 7 to 9. An equation was derived to express the fluorescence at a fixed pH in terms of the measured fluorescence at any pH. Fluorescence intensity and position of the emission maximum were the same at a given pH in spite of two cycles of pH changes. This proved that the original structure of the fluorescent matter had not been altered by pH changes. Two slopes were evident in the pH-fluorescence curve, one at pH 8 suggesting ionization of an ammonium and/or phenol group, and one at pH 3 suggesting the ionization of sulfonyl and/or carboxylic acids. These results indicate that fluorescent matter is mainly allochthonous and behaves conservatively during transport through the estuary. Further work is required to determine whether fluorescent matter is produced in situ. (Cassar-FRC)
W83-01128

RESPONSES OF EXPERIMENTAL ESTUARINE COMMUNITIES TO CONTINUOUS CHLORINATION,
Environmental Research Lab., John's Island, SC. Bears Bluff Field Station.
For primary bibliographic entry see Field 5C.
W83-01131

MECHANISM GOVERNING THE ESTUARINE CIRCULATION IN DEEP, STRONGLY STRATIFIED FJORDS,
Goeteborg Univ. (Sweden). Dept. of Oceanography.
A. Stigebrandt.
Estuarine, Coastal and Shelf Science, Vol. 13, No. 2, p 197-211, August, 1981. 6 Fig, 1 Tab, 16 Ref.

Descriptors: *Fjords, *Water circulation, *Model studies, Stratification, Estuarine environment, Estuaries, Mixing, Vertical distribution, Brackish waters, Salinity, Runoff, Mathematical equations, Density, *Sweden, Nordfjord.

A simple but physically realistic model for steady estuarine circulation has been developed. The new model is based on an already existing model for steady estuarine circulation in a wide fjord, a particularly simple system as horizontal gradients within the fjord are small. Salinity and depth of the brackish layer are supposed to be horizontally homogeneous. For the present model it is argued that a two-layer description of fjord stratification is correct for very wide fjords and possibly also in narrow fjords with high runoff and/or weak mixing. Among other findings from the theory is that the thickness of the brackish layer is primarily determined by the internal hydraulic control for high specific runoff and weak mixing. At the other extreme, with low specific runoff and strong mixing, the thickness of the brackish layer was found to be proportional to the Monin-Obukhov length. Circulation in not very wide fjords is also discussed. It is found that recirculation in the brackish layer may be expected, whereby a two-layer description of the flow field breaks down at least locally. A critical Rayleigh number that seems to control the recirculation of brackish water within the fjord is found. A theory for the density difference between the mouth and the head of the brackish layer in the fjord is developed from the critical Rayleigh number condition. This density difference is normally proportional to the density difference between the brackish water at the mouth and the underlying sea water, provided that the river runoff is not too heavy and/or the mixing is not too weak. This prediction is confirmed by extensive measurements from the Nordfjord. (Baker-FRC)
W83-01132

MATHEMATICAL MODEL FOR PARTIALLY MIXED ESTUARIES USING THE TURBULENCE ENERGY EQUATION,
Institute of Oceanographic Sciences, Birkenhead (England).
T. J. Smith, and H. S. Takhar.
Estuarine, Coastal and Shelf Science, Vol. 13, No. 1, p 27-45, July, 1981. 8 Fig, 54 Ref.

Descriptors: *Estuarine environment, *Model studies, *Turbulence, *Turbidity, *Mathematical equations, Mathematical studies, Mixing, Estuaries, Reynolds number, *Stratification, Density stratification, Viscosity, *Salinity.

The model for width averaged tidal flow as described by Smith and Takhar in 1979 has been extended to include the effects of density stratifica-

tion. The model is applied to an idealized estuary with the aims of demonstrating the characteristics of turbulence closure models in partially mixed tidal flows and assessing their advantages over mixing length closures due to their increased generality. To reduce the computational effort without any loss of generality of the results, a two-dimensional, width-averaged approximation was used. The model was then applied to an idealized estuary similar in topography to the Rotterdam Waterway, the Netherlands, for which the dispersion due to lateral mean velocity shear and lateral salinity variations had been shown to be negligible. The model as developed was based on the laterally integrated momentum, continuity and salt balance equations. The dominant Reynolds stress and the vertical turbulent transport of salt were modelled by an effective diffusion hypothesis in which the eddy coefficients were determined from the solution of the turbulence energy equation. The efects of density stratification on the turbulence energy, the eddy viscosity and the turbulent Schmidt number were included. During model application, the dispersion coefficient was identified as an important parameter in quantifying both the horizontal and vertical structure of the flow and salinity distributions in laterally integrated representations of partially mixed estuaries. (Baker-FRC)
W83-01133

A NOTE ON TIDAL ASYMMETRY IN THE SEVERN ESTUARY,
Institute for Marine Environmental Research, Plymouth (England).
R. J. Uncles.
Estuarine, Coastal and Shelf Science, Vol. 13, No. 4, p 419-432, October, 1981. 4 Fig, 8 Ref.

Descriptors: *Estuarine environment, *Tidal hydraulics, Water currents, Water circulation, Numerical analysis, Severn Estuary, *England.

A one-dimensional, non-linear numerical model is used to investigate the tidally averaged frictional stress and set-up of water level due to tidal asymmetry in the Severn Estuary. These quantities depend on the overtides in the region. A linearized model of the overtides is applied to calculations of the M4 currents in order to delineate the mechanisms responsible for their generation. The relative importance of individual non-linear mechanisms to the tidally averaged stress and set-up is determined. These mechanisms are interactions between tidal flow and changes in depth or breadth over a cross-section, frictional interaction between the tidal flow and Stokes drift, interaction between the tidal fluctuations in water depth and frictional retardation, and non-linear advection. (Baker-FRC)
W83-01134

SIMULATING THE LATERAL TRANSPORT OF ICHTHYOPLANKTON IN THE POTOMAC ESTUARY,
Maryland Univ., Solomons, Center for Environmental and Estuarine Studies.
R. E. Ulanowicz, J. M. Lindsay, W. C. Caplins, and T. T. Polgar.
Estuaries, Vol. 5, No.1, p 57-67, March, 1982. 6 Fig, 19 Ref.

Descriptors: *Entrainment, *Fish eggs, *Environmental effects, Larvae, Eggs, Ichthyoplankton, Plankton, Estuaries, Nuclear powerplants, Cooling water, Intakes, Powerplants, Model studies, Hydrodynamics, Douglas Point Nuclear Station, *Maryland, Bass, *Potomac estuary.

Two-dimensional, vertically-averaged hydrodynamic and kinematic models of passive organism transport were developed to represent advective and dispersive processes at the proposed Douglas Point Nuclear Generating Station, Maryland. This more refined model did not produce significantly better estimates of ichthyoplankton (striped bass) entrainment than coarser models, because the volume of cooling water withdrawal was only a small fraction (2.25 cu m per sec) of the average flow rate (370 cu m per sec) and peak tidal flow (6500 cu m per sec). However, the model was able to predict entrainment rates of 0.6% to 2.6% on opposite sides of the estuary. (Cassar-FRC)
W83-01136

THE STRUCTURE OF TWO SOUTH CAROLINA ESTUARINE TIDE POOL FISH ASSEMBLAGES,
South Carolina Univ., Columbia.
R. E. Crabtree, and J. M. Dean.
Estuaries, Vol. 5, No. 1, p 2-9, March, 1982. 3 Fig, 6 Tab, 16 Ref.

Descriptors: *Tidal rivers, *Fish populations, Estuaries, North Edisto River, *South Carolina, Leadenwah Pool, Rivers, Tidal marshes.

The fish assemblages of two tidal pools (North Edisto and Leadenwah) on the North Edisto Estuary, South Carolina, were sampled by haul seine, lift net, and channel net. In June-October 1977 samples were collected during daytime low tides; in June-July 1978, during daytime high tides. In Leadenwah Pool a total of 6686 fish comprising 18 species were caught; in North Edisto, 10,461 fish comprising 31 species. Dominant species were Fundulus heteroclitus, Leiostomus xanthurus, Menidia menidia, and Anchoa mitchilli. Areas of oyster substrate were dominated numerically by Gobiosoma bosci and F. heteroclitus. The fish assemblage was similar to that found in other tidal creeks, but was different from that obtained by otter trawl sampling in the deeper river water. (Cassar-FRC)
W83-01137

THE DEPOSITION OF WINDSCALE RADIOCAESIUM IN THE WYRE ESTUARY AND THE MEASUREMENT OF SEDIMENTATION RATES,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5B.
W83-01138

OHIWA HARBOUR, NATURAL VALUES,
Ministry of Agriculture and Fisheries Auckland (New Zealand). Fisheries Management Div.
For primary bibliographic entry see Field 6G.
W83-01146

AN IMPROVED METHOD OF DETERMINING SEDIMENTATION RATES BY THE USE OF ARTIFICIAL RADIONUCLIDES,
Lancaster Univ., Bailrigg (England). Dept. of Environment Sciences.
For primary bibliographic entry see Field 2J.
W83-01153

STATISTICAL ANALYSIS OF ESTUARINE PROFILES: APPLICATION TO MANGANESE AND AMMONIUM IN THE TAMAR ESTUARY,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
S. Knox, D. R. Turner, A. G. Dickson, M. I. Liddicoat, and M. Whitfield.
Estuarine, Coastal and Shelf Science, Vol 13, No 4, p 357-371, October, 1981. 9 Fig, 5 Tab, 18 Ref.

Descriptors: *Estuaries, *Model studies, *Manganese, *Ammonium, Tamar Estuary, Estuarine environment, *Chemical analysis, *Statistical analysis, Mathematical studies, Interstitial water, Mixing, Predictions, Projections, *England.

A model for the formation of manganese and ammonium maxima in the Tamar Estuary was investigated. By selecting two chemical components that can be postulated to arise from the same source it has been possible to present a simple and largely objective approach to the analysis of field data that avoids placing undue weight on the potentially variable end-members and yields mean values for the concentration ratios of the components of interest in the water column. The simple statistical model also enables these ratios to be compared with corresponding ratios measured directly in the interstitial water that is postulated as providing the source of the dissolved components. By combining these independent sets of information it is possible to provide a clear and consistent account of the major processes responsible for manganese and ammonium ion profiles in the Tamar Estuary. It is suggested that this approach is more fruitful than the subjective analysis of concentration profiles by comparing the data visually to hypothetical ideal mixing lines. (Baker-FRC)
W83-01154

PRIMARY PRODUCTION IN A TURBID ESTUARY,
Institute for Marine Environmental Research, Plymouth (England).
I. R. Joint, and A. J. Pomroy.
Estuarine, Coastal and Shelf Science, Vol 13, No 3, p 303-316, September, 1981. 7 Fig, 4 Tab, 25 Ref.

Descriptors: *Primary productivity, *Estuarine environment, *Turbidity, Bristol Channel, *England, Euphotic zone, Zones, Phytoplankton, Chlorophyll A, Nutrients.

Primary production is described in the Bristol Channel, England, a very turbid estuary with a large riverine input of inorganic nutrients and a long flushing time. The study was made to quantify the phytoplankton production of the area and to supply data on phytoplankton standing stocks and rates of primary production for use in a general ecosystem simulation model of the Bristol Channel which has been developed to simulate the flow of energy through the ecosystem. The euphotic zone extends from less than 0.5 m to greater than 10 m. The standing stock of phytoplankton chlorophyll a was measured in 1973 and 1974 and was similar throughout the Bristol Channel, but the rate of primary production was 6.8 g C/sq m for the most turbid region and 164.9 g C/sq m for the Outer Bristol Channel. A larger proportion of the annual primary production occurred in the spring in the Outer Channel compared to the most turbid regions. Phaeocystis developed into blooms in some, but not all, years and exhibited a different light saturation curve from other phytoplankton populations. Serial incubations of short duration gave higher fixation rates than day long incubations, and it is argued that photoinhibition is probably insignificant in a mixed water column. Excretion rates of dissolved organic carbon by phytoplankton were always low. (Baker-FRC)
W83-01155

DYNAMICS OF MUD (SLICK) AND SUSPENDED MATTER IN ESTUARIES. APPLICABILITY OF BY-PRODUCTS OF SURVEYS OF GERMAN COASTAL AGENCIES IN VIEW OF REQUIREMENTS FOR FUTURE NEEDS,
Deutsches Hydrographisches Inst., Hamburg (Germany, F.R.).
For primary bibliographic entry see Field 2J.
W83-01161

THE ESTUARINE ZONE, AN OVERVIEW,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
G. A. Knox.
Soil and Water, Vol 16, No 2, p 13-17, April, 1980. 2 Fig.

Descriptors: *Estuaries, *Water pollution effects, *Water resources development, Water quality, Industrial wastes, Environmental effects, *New Zealand.

An estuarine system includes the water body, or basin, and the marginal areas around its edge which are flooded by the tides and storms. This marginal area includes the tideflats and mud flats, the tidal salt marshes and mangroves, and the upper wetlands. Estuarine circulation patterns and salinity distributions are among the most distinctive known patterns of water movement. Estuarine sediments are unique, having specific characteristics and high complexity. The most significant characteristic of the true estuarine environment is the instability of the system, and this determines the main biological features. Estuaries are particularly valuable in the overall economy of coastal water. Some of the most important producers at the base of the food chain live in the estuaries. Estuarine environments are particularly vulnerable to human impact. Their vulnerability lies in the sensitivity of the life that thrives in them and the

fact that they are a natural pollutant trap. Estuaries throughout the world have always been preferred sites for human settlement. All large coastal cities in New Zealand are situated on estuarine water bodies; thus the estuaries have often been subjected to the most intensive use applied to any marine area. The future of estuaries calls for increasing care and understanding in their management. (Baker-FRC)
W83-01163

VELOCITY VARIATIONS IN SALT MARSH CREEKS, NORFOLK, ENGLAND,
Edinburgh Univ. (Scotland). Dept. of Geography.
R. G. Healey, K. Pye, D. R. Stoddart, and T. P. Bayliss-Smith.
Estuarine, Coastal and Shelf Science, Vol 13, No 5, p 535-545, November, 1981. 8 Fig, 8 Ref.

Descriptors: Salt marshes, *Velocity, *Geomorphology, Norfolk, *England, Coastal waters, Tidal flows, Warham marshes.

The importance of velocity pulses on the flood and ebb tides in salt marsh creeks has been noted in several studies, but no satisfactory explanation of the causal mechanisms has been made as yet. This paper presents a critical analysis of existing models in the light of new field data from the Warham marshes, Norfolk, England. Although continuity models have the advantage of providing a simple picture of tidal flows in salt marsh creeks, which allows predictions to be made about velocity changes, the data presently available suggests that they may invert part of the causal sequence linking the hydraulic variables. The continuity approach suggests that velocity is a function of the rate of tidal stage rise, which is considered to be an independent variable, whereas field data suggest that velocity via discharge partly controls the rate of tidal stage rise within the marsh system. Field observations made at Warham have also shown that the asymmetries of below marsh and over marsh tides differ significantly, and that the shape of the stage-time curves is partly influenced by the movement of water across the marsh surface. The preliminary findings suggest that water surface slopes may play a bigger role in the generation of velocity pulses than has been generally recognized, but further data are required before their precise importance can be clarified. (Baker-FRC)
W83-01176

THE TIDAL INSTRUSION FRONT: AN ESTUARINE CONVERGENCE ZONE,
University Coll. of North Wales, Bangor. Marine Science Labs.
J. H. Simpson, and R. A. Nunes.
Estuarine, Coastal and Shelf Science, Vol 13, No 3, p 257-266, September, 1981. 7 Fig, 9 Ref.

Descriptors: *Estuarine environment, *Tidal floods, *Tidal currents, *Density currents, Water currents, Density, Water circulation, *Wales, River Seiont.

Freshwater discharge in a small estuary flows seaward as a density current, which is forced back into the estuary during the flood phase of the tidal streams. The development of the two layer flow and the associated frontal structure is described. The front exhibits a V configuration, with an isolated point convergence at its apex and an associated gyre system. Representative examples of the two-layer structure show that it extends upstream of the front, with about 50 cm of freshwater overlying the intruding straits water which has a salinity of about 32 o/oo. A region of intense surface gradients occurs at the transition to the almost vertically uniform high salinity regime. At this point the intruding saline water can be seen plunging below the freshwater layer with an intense surface convergence, clearly identified by accumulations of surface material. Just upstream of this point there is a system of eddies in which the collected surface material rotates. At times a pair of symmetrical vortices are apparent, but more frequently a single eddy predominates. Surface flow relative to the front is toward it on both sides. On reaching the front, surface freshwater sinks and is swept back upstream. In calm conditions a train of capillary waves may sometimes be observed just downstream of the advancing freshwater. (Baker-FRC)
W83-01177

IN SITU SURVIVAL OF ENTERIC BACTERIA IN ESTUARINE ENVIRONMENTS OF DIFFERENT NUTRIENT CHARACTERISTICS,
Virginia Inst. of Marine Science, Gloucester Point.
M. W. Rhodes, and H. I. Kator.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-140038, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, October, 1982. 47 p, 11 Fig, 1 Tab, 62 Ref. OWRT A-093-VA(1).

Descriptors: *Fecal coliforms, *Enteric bacteria, *Pathogenic bacteria, Estuaries, Shellfish, *Sublethal stress, Lethal limit, Virginia, Ware River, Sewage outfalls, Water pollution effects, *Escherichia coli, *Salmonella spp.

Survival and development of sublethal stress were determined for Escherichia coli and Salmonella spp. exposed in membrane diffusion chambers to estuarine waters of different chemical and physical characteristics. Sublethal stress was assessed using direct selective versus resuscitative enumeration procedures and an electrochemical detection method. In general, increased survival and decreased stress resulted from exposure in a shallow tidal creek 4.3 km downstream of a sewage outfall as opposed to a second site located an additional 7.1 km downstream in the Ware River. Dieoff and sublethal stress in filtered estuarine water were inversely related to water temperature. However, salmonella populations exhibited significantly less dieoff and stress than E. coli at water temperatures less than 10 degrees Centigrade. While exposure to autochthonous microbiota reduced densities of both test bacteria, some remained after two weeks exposure at temperatures greater than 15 degrees Centigrade. Survival differences in membrane-filtered versus nonfiltered estuarine water were most pronounced at warmer temperatures. Bacterial dieoff at warm temperatures was associated with increases in microflagellate densities as measured by epifluorescence microscopy and of lytic microorganisms enumerated as plaque-forming units. These studies demonstrated that indicator and pathogenic enteric bacteria can survive for extended periods in estuarine waters and that under adverse conditions of low temperature survival patterns of E. coli and salmonellae may differ significantly. The prolonged persistence of Salmonella spp. as compared to E. coli under cold water conditions suggests that fecal coliforms may be an inadequate indicator of pathogens during the prime months of shellfish harvesting.
W83-01281

THE DEVELOPMENT OF PHYTOPLANKTON POPULATIONS AND NUTRIENTS IN A TIDAL RIVER UNDER DROUGHT CONDITIONS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W83-01283

THE DYING ESTUARY,
For primary bibliographic entry see Field 6G.
W83-01291

SOME DIATOMS FROM BRACKISH WATER HABITATS IN SOUTHERN IRAQ,
Sulaimaniyah Univ. (Iraq). Dept. of Biology.
G. C. F. Hinton, and B. K. Maulood.
Nova Hedwigia, Vol 33, No 1-2, p 475-486, 1980. 41 Fig, 1 Tab, 9 Ref.

Descriptors: *Coastal marshes, *Deltas, *Diatoms, *Taxonomy, *Iraq, Marshes, Salt marshes, Estuaries, Rivers, Plankton, Species, Composition, Species diversity, Phytoplankton, Algae, Chrysophyta.

A study of the taxa of a marsh area of Southern Iraq was carried out to identify the planktonic diatoms before drainage of the area in the near future. The area studies was the delta flats of the Tigris and Euphrates Rivers. Water samples for diatom identification were collected from various depths at each of eight stations using a Van Dorm closing sampler. Seventy-seven taxa were recorded from the brackish waters, 67 of which were identified in previous marsh studies. Descriptions of the taxa are supplemented by digrams. (Geiger-FRC)
W83-01306

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

CHEMICAL OSMOSIS, REVERSE CHEMICAL OSMOSIS, AND THE ORIGIN OF SUBSURFACE BRINES,
Illinois Univ. at Urbana Champaign. Dept. of Geology.
For primary bibliographic entry see Field 2K.
W83-01143

APPLICATION OF NON-FOULING ULTRAFILTRATION MEMBRANES IN WATER CONVERSION TECHNOLOGY,
H. P. Gregor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139998, Price codes: A07 in paper copy, A01 in microfiche. Report, WAPORA, Inc., Chevy Chase, Maryland, Project 642, August 30, 1982. 128 p, 37 Fig, 11 Tab, 43 Ref, 3 Append. OWRT(7517). 14-34-0001-7517(1).

Descriptors: *Ultrafiltration, *Membrane processes, *Desalination, Reverse osmosis, Electrodialysis, Water quality management, Brackish water, Seawater, Saline water.

The most promising technologies available for treating brackish or saline water are the membrane separation processes of reverse osmosis (RO), ultrafiltration (UF), and electrodialysis (ED). The fouling of UF, ED, and RO membranes has been the principal deterrent to their widespread application. A new, non-fouling UF membrane was studied to explore its feasibility in conjunction with conventional wastewater treatment, and its operation in a pilot plant at the Desalting Test Facility in Yuma, Arizona. Initial laboratory tests were carried out with water samples which included salt water, brackish water, synthesized Yuma feed water, and actual Yuma feed water. Further studies were conducted to compare the performance of RO and ED systems with untreated feed water and with feed water pretreated by UF. UF proceeded to a high degree of water recovery in the absence of any flux decline in tests on sea water and brackish water. Results of the RO treatment of Yuma canal water with and without UF pretreatment showed the advantages of this pretreatment water. In pilot plant tests, two connected systems were installed and operated at the Desalting Test facility: a device that performed UF on raw water; and a system consisting of two RO units, one operating on effluent from the pretreatment plant, and the other from the UF device. The shutdown of the Yuma facility forced the termination of these tests. (Moore-SRC)
W83-01277

DEVELOPMENT OF A 100,000 GPD BRACKISH WATER MODULE,
Dow Chemical Co., Walnut Creek, CA. Western Div.
G. B. Clark.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146704, Price codes: A04 in paper copy, A01 in microfiche. Final Report, March 29, 1981. 67 p, 41 Fig. OWRT C-80323-S(8549)(1).

Descriptors: *Desalination apparatus, *Reverse osmosis, *Computers, Membrane processes, Desalination, Flow characteristics, Hollow fiber reverse osmosis, Water treatment, Brackish water.

A large, computer controlled, helical wound, hollow fiber, reverse osmosis desalting module having improved flow characteristics was developed, fabricated, and tested. A single large 16 x 96 in. module bundle was developed in lieu of two smaller units housed in a common enclosure as was originally proposed. The final module design incorporates two active tubesheets and eliminates dead end tubesheet. Test data confirmed the advantages of helical wound, controlled flow patterns in large module bundles. The 'outside-in' flow provisions in the design resulted in extremely low pressure differentials with polarization effects reduced by over 25%. The final module assembly, equal in production to six commercial modules, is contained within an 18 x 96 in. pressure vessel and is the largest single module, in output, to be produced to date. The final module produced 138,425 gallons per day after 500 hours of testing at 400 psi and 1200 ppm brackish water. A projected 125,000 gallons per day at the end of three years was calculated based on the .013 slope. (Moore-SRC)
W83-01352

ISOLATION AND CONTROL OF MEMBRANE FILTER DEGRADING MICROORGANISMS,
New Mexico State Univ., Las Cruces. Dept of Agronomy.
W. C. Lindemann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146407, Price codes: A04 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, WRRI Report No 139, Las Cruces, December 1981. 61p, 18 Tab, 33 Ref. OWRT C-90059-D(9508)(1).

Descriptors: *Reverse osmosis, *Desalination, *Cellulose acetate membranes, *Membrane processes, *Microbial degradation, *New Mexico, Microbiological studies, Salt rejection, Water treatment.

Reverse osmosis filtration is one of the most widely used methods of desalinization and cellulose acetate is the most common membrane material. The Roswell Test Facility (New Mexico) reverse osmosis testing program was plagued with premature failure of cellulose acetate reverse osmosis membranes. Microbial degradation of the membranes was thought to be the cause. Microorganisms were isolated from various membranes and waters and tested for their ability to degrade cellulose acetate preparations and membrane strip. None of the microorganisms isolated or enrichment cultures from facility membranes were found to degrade cellulose acetate. The microorganisms isolated were common soil and water inhibitants. Those membranes with high microbial populations generally had good salt rejection capabilities while those membranes with low microbial populations had the greatest decline in salt rejection capabilities. No evidence or microorganisms were found to support the microbial degradation hypothesis during the course of this study. The degradation of cellulose acetate membranes and other possible causes for membrane failure were discussed. (Moore-SRC)
W83-01359

DEVELOPMENT OF NEW CLEANING TECHNIQUES FOR REVERSE OSMOSIS MEMBRANES,
Dow Chemical Co., Walnut Creek, CA.
J. A. Johnson, and T. M. Leahy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146746, Price codes: A09 in paper copy, A01 in microfiche. Report, March 30, 1982. 183 p, 52 Fig, 15 Tab, 14 Ref, 5 Append. OWRT C-80152-S(8519)(1). 14-34-0001-8519.

Descriptors: *Reverse osmosis, *Membrane processes, *Cleaning, *Desalination apparatus, San Joaquin River, Brackish water, Suspended solids, Cost analysis, Silt, California.

Reverse osmosis permeators are susceptible to fouling by suspended solids in the feedwater. Several cleaning methods for the control of silt fouling were tested and compared. The flow reversal cleaning method, where a permeator flush stream is periodically switched from a feed-to-brine to a brine-to-feed flow direction, appeared the most effective of the methods tested. When cleaning techniques were combined, cleaning effectiveness was improved slightly. The addition of a surfactant to the cleaning flush stream improved the effectiveness of all of the cleaning methods by an average of 55%. Comparison of performance results between separate testing phases indicates that experimental operating conditions were not consistent between phases. This has been attributed to: seasonal changes in the San Joaquin River feed water; upsets in clarifier operation; and limitations in the ability to measure and control the fouling tendency of the feed water. Scaling of the membrane surface had occurred in some tests. The capital and operating costs associated with applications of the flow reversal with surfactant and the drain/refill with surfactant cleaning techniques on a 0.5 million gpd brackish water reverse osmosis system were developed. Flow reversal cleaning of such a system once every six days, or less, would be economically beneficial. It is believed that the installation of a cleaning system may allow operation on a feedwater with higher than presently acceptable fouling potential, and membrane lifetime may be improved. The availability of an on-line cleaning system may prevent the necessity of membrane replacement in the event of severe pretreatment system upsets. (Moore-SRC)
W83-01369

DESALINATION-POWER CYCLES WITH THE BIPHASE ROTARY SEPARATOR TURBINE, PHASE 3,
Biphase Energy Systems, Santa Monica, CA.
P. L. Limburg, E. Walsh, and D. Rovener.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146753, Price codes: A07 in paper copy, A01 in microfiche. Final Report, February 1982. 121 p, 58 Fig, 7 Tab, 11 Ref. OWRT C-00156-D(0490)(1).

Descriptors: *Fluidized-bed, *Heat-exchanger, *Turbines, Waste-heat-recovery, Scale, Corrosion, Erosion, Rotary-separator turbine, Energy-recovery, *Desalination, *California, San Nicolas Island.

Tests of a fluidized-bed seawater heat exchanger showed that 330 degrees F was the maximum temperature to which seawater could be heated without scale formation in the bed during once through flow of seawater. Twelve material and coating combinations were exposed to a two-phase salt-water jet to simulate the environment of rotary-separator-turbine rotor materials. The materials, except for bare aluminum and some brittle coatings, passed four-hour screening tests. A hydraulic version of the Biphase reaction turbine can recover reverse-osmosis reject-brine pressure energy with efficiency of over 70%. A two-phase version can recover pressure energy and provide additional power for pumping from a waste heat source. Integration of a high-pressure reverse-osmosis pump into the turbine is not as efficient as using a separate pump and turbine coupled together. A system configuration was developed for a desalination-power system which uses the waste heat from diesel engines in the power plant at San Nicolas Island, CA.
W83-01370

3B. Water Yield Improvement

EFFECTS OF ARTIFICIAL CONIFER FOLIAGE ON COLLECTION OF PRECIPITATION AND NUTRIENTS IN COASTAL BRITISH COLUMBIA,
Toronto Univ. (Ontario). Dept. of Botany.
For primary bibliographic entry see Field 2I.
W83-01218

THE HYDROGEOLOGY OF ALLUVIAL AQUIFERS IN OR BORDERING THE DISSECTED TILL PLAINS,
Missouri Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 2F.
W83-01269

THE ONFLOW OF IRRIGATION SCHEMES,
Ministry of Agriculture and Fisheries, Ashburton (New Zealand).
J. G. Spall.
Soil and Water, Vol. 17, No. 2, p 17, April, 1981.

Descriptors: *Irrigation engineering, *Water resources development, *Farm management, Evaluation, Ashburton-Lynhurst, Waitaki, Water supply, Available water, Crop yield, Farming, *New Zealand.

The effects of irrigation schemes on the districts in which they are constructed are considered. The development of the Ashburton-Lyndhurst scheme, where water first became available in 1945, is compared with the development of the lower Waitaki plains, where scheme water first became available in 1968. While substantial achievements were made within the irrigation scheme, with increases in stocking rate, farm values, carrying capacity and density of settlement, equally impressive developments occurred in the dryland zone. When these findings were compared to a more recent scheme development area, much faster development was noted in the irrigated area. It was concluded that a great deal of knowledge was gleaned from the earlier systems, and this has helped the newer systems achieve significant development in short periods of time. Some of the development occurring since 1976 include a more to irrigate all irrigable areas on some farms, automation of manual systems, and all-grass wintering. It is felt that only in the 1970s did irrigation farming systems come of age. (Baker-FRC)
W83-01318

MUNICIPAL FRACTURED-ROCK WELLS,
B. Caswell.
Water Well Journal, Vol 36, No 9, p 40-41, September, 1982.

Descriptors: *Water supply development, *Wells, *Geologic fractures, Fault springs, Water supply, Drinking water, Radon, Path of pollutants, Water quality, Well water.

Problems which must be considered in planning to use bedrock wells for municipal water supplies are noted. These concerns include the thought that the sustained (safe) yield is not predictable, and therefore the supply is unreliable; contaminants may move directly into open surface fractures and pollute the supply; contaminants may be transported along unknown faults and fissures from sources that are miles from the well; and the necessary protective zone around the well is indefinable. Another problem which is sometimes voiced concerns the occurrence of radon gas in groundwater from some granitic and metamorphic rocks. If present it may preclude the use of the groundwater unless treatment is offered. Development of fractured-rock aquifers for municipal water supply requires some adjustment and more complete application of existing exploration and analysis techniques. There is no reason for regulatory authorities to assume that fractured-rock aquifers cannot be satisfactory sources of municipal water supply. (Baker-FRC)
W83-01350

3C. Use Of Water Of Impaired Quality

LEGAL ISSUES IN IMPLEMENTING WATER REUSE IN CALIFORNIA,
California Univ., Berkeley.
For primary bibliographic entry see Field 6E.
W83-01074

RESULTS OF PRELIMINARY EXPERIMENTS ON THE INFLUENCE OF FABRICS ON THE MIGRATION OF GROUNDWATER AND WATER-SOLUBLE MINERALS IN THE CAPILLARY FRINGE,
Queen Mary Coll., London (England). Dept. of Geological Science.
For primary bibliographic entry see Field 8G.
W83-01253

3D. Conservation In Domestic and Municipal Use

WATER RESOURCE MANAGEMENT AND CONSERVATION FOR THE FUTURE,
North Carolina State Univ. at Raleigh. Dept. of Psychology.
F. J. Smith, S. P. Gordon, and T. M. Powers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139931, Price codes: A08 in paper copy, A01 in microfiche. Water Resources Research Institute of the University of North Carolina Report No 177, July 1982. 168 p, 6 Fig, 27 Tab, 121 Ref, 2 Append. OWRT B-121-NC(1). 14-34-0001-9127.

Descriptors: *Water conservation, *Water management, *Public opinion, *Industrial water, *Water use, *Municipal water, North Carolina, Attitudes, Water resources development, Water shortage, Social aspects.

Water conservation is the focal point for a set of integrated studies that attempt to lay the groundwork for appropriate water resource management for the future. The research includes surveys of water use in homes and industries, organizational analyzed of management perceptions and information needs, evaluation of a community incentives program for conservatio, and systems analysis of conservation behavior. Data for all studies were developed on the basis of a common sample frame consisting of 54 communities across North Carolina: 544 scientific interviews were completed which yielded new information on 726 different variables relating to water resources management and conservation. The survey of heads-of-households, industrial representatives and local water managers confirms that shortages of water supply represent a serious threat to the wellbeing of many North Carolina communities. In the past five years, 28% of households and 20% of industries sampled have suffered the effects of water supply shortages. The survey uncovered a large reservoir of citizen and industry support for water conservation. Trail-and-error approaches to water conservation will probably be inadequate, given the social complexity of the problem. Currently, conservation activities are viewed as a peripheral part of management responsibility and reform of management training, institutional priorities, and informational support will be required to make conservation an integral part of water resource management. (Moore-SRC)
W83-01274

MORE OR LESS WATER,
Friends of the Earth, Nelson (New Zealand).
For primary bibliographic entry see Field 6G.
W83-01317

PLANNING FOR DROUGHTS,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 6D.
W83-01347

AN INVESTIGATION OF PSYCHOLOGICAL COMPONENTS OF WATER CONSERVATION BEHAVIOR,
North Carolina State Univ. at Raleigh. Dept. of Psychology.
S. P. Gordon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146688, Price codes: A08 in paper copy, A01 in microfiche. PhD Thesis, 1981. 158 p, 4 Fig, 14 Tab, 73 Ref, 6 Append. OWRT B-121-NC(2). 14-34-0001-9127.

Descriptors: *Water conservation, *Behavior, *Attitudes, *North Carolina, Public opinion, Public participation, Wake County.

A model of prerequisite psychological components to water conservation behavior specifies that four sequential psychological conditions must be satisfied before conservation behavior will occur. These components are: noticing water resource cues/facts; interpreting the relationship between events in the water resource system; feeling responsible for the state of water resources; and knowing about water conservation behavior. A scale measuring each of the four predictor components and a criterion scale of conservation actions was developed. These scales were compiled in a survey instrument and administered to 302 citizens in five communities throughout the Wake County area of North Carolina. The responsibility component was found to be the strongest single predicator of conservation actions, and the notice component was a strong predictor of responsibility. This finding suggests that conservation programs should attempt to increase responsibility and that an element in this effort should be increasing awareness of water resource issues. The knowledge component was found to have a weak negative direct path to actions and indicates that teaching citizens about conservation methods will not increase conservation behavior. Although there is no direct path between interpret and action, the interpret component was found to be highly predictive of knowledge. (Moore-SRC)
W83-01363

3E. Conservation In Industry

WATER RESOURCE MANAGEMENT AND CONSERVATION FOR THE FUTURE,
North Carolina State Univ. at Raleigh. Dept. of Psychology.
For primary bibliographic entry see Field 3D.
W83-01274

3F. Conservation In Agriculture

RESPONSES TO WATER STRESS IN WHEAT AND RELATED WILD SPECIES,
Agricultural Research Organization, Bet-Dagan (Israel). Inst. of Soils and Water.
D. Shimshi, M. L. Mayoral, and D. Atsmon.
Crop Science, Vol. 22, No. 1, p 123-128, January/February 1982. 5 Fig, 28 Ref.

Descriptors: *Water stress, *Wheat, *Drought resistance, *Triticum, *Agropyrum junceum, Leaves, Water potential, Stomata, *Soil-water-plant relationships, Carbon dioxide.

Drought resistance indicators were studied in wheat (Triticum aestivum, Chinese Spring and Seeon) and three related wild species: T. longissimum, an annual growing in subhumid to semiarid habitats, mostly on sandy soils; T. kotschyi, an annual growing on the Negev Desert; and Agropyrum junceum, a littoral halophytic perennial. Potted plants subjected to water stress wilted within 5 days, except for A. junceum, which lasted up to 12 days. The following indicators of drought resistance were compared: effect of soil moisture on leaf water potential (LWP), relationship between relative water content and LWP, effect of LWP on leaf permeability, effect of LWP on CO2 fixation, and recovery following rewatering of water stressed plants. A. junceum, which proved to be the most drought resistant species in the study, was different in anatomy and morphology from the Triticum species. It maintained a constant LWP through a wide range of soil moisture depletions, and its rare of CO2 fixation remained relatively unaffected down to a LWP of -2.0 MPa. T. kotschyi almost always ranked highest, and wheat almost always lowest, in drought resistance indices. T. longissimum was intermediate. However, T. longissimum stomatal aperature recovery was faster after water stress and rewatering than T. kotschyi and wheat. (Cassar-FRC)
W83-01145

A GREENHOUSE LINE-SOURCE SPRINKLER SYSTEM FOR EVALUATING PLANT RESPONSE TO A WATER APPLICATION GRADIENT,
Utah State Univ., Logan. Crops Research Lab.
D. A. Johnson, M. D. Rumbaugh, L. S. Willardson, K. H. Asay, and D. N. Rinehart.
Crop Science, Vol 22, No 2, p 441-444, March/April, 1982. 4 Fig, 11 Ref.

Descriptors: *Sprinkler irrigation, *Irrigation design, *Greenhouses, *Alfalfa, *Water stress, Line-source sprinkler systems.

A greenhouse line-source sprinkler system for applying a uniform water gradient was designed for examining seedling response to water stress. The sprinkler chosen from among 20 variations was a Delevan spray nozzle with standard brass body, A Delevan LF2-80 degree tip, and a 50 mesh brass nozzle strainer. The transport mechanism was a steel plate equipped with 4 steel rollers. This plate was pulled along an angle iron track by a reversible gear motor, which was attached to a set of pulleys and a 0.3 cm diameter stainless steel wire rope. The nozzle, operated at 3.3 MPa pressure, traversed the length of the bed (about 5 m) in 15 min, corresponding to a maximum water application of 1.4 mm. The nozzle returned to the starting point for subsequent applications. Water application was uniform from one end of the greenhouse to the other but varied from center to outer edges. Tests on alfalfa seedlings showed that mean shoot dry weight (0.20 g at the edge to 0.34 g in the center) varied with the average daily water application (0.32 cm per day at the edge to 0.69 cm per day at the center). In the area of highest water application there was a slight decrease in mean shoot weight, indicating an excess of water at that location. (Cassar-FRC)
W83-01162

SCHEDULING IRRIGATION BY COMPUTER,
Oregon State Univ., Corvallis.
M. English.
Soil and Water, Vol 16, No 2, p 10-12, April, 1980. 1 Fig, 2 Tab.

Descriptors: *Irrigation efficiency, *Scheduling, *Computers, Planning, Water management, Erosion control, Leaching, Runoff, Irrigation, Irrigation practices, Irrigation programs, Surface runoff, Organic compounds, Farm wastes, Water pollution control.

The scientific scheduling of irrigation is considered, employing computers in combination with specially trained personnel working in the field. The field personnel use the computer to estimate soil moisture conditions from day to day. They periodically visit each field to determine the actual soil moisture content. When irrigation is called for, the field expert will consult with the farmer on the appropriate timing and the amount of water to apply. The procedure is based on principles of soil science, agronomy, meteorology and engineering. A number of benefits should be derived from such planning. The farm operator should benefit through reduced water and labor use. Important environmental benefits may also be realized. Deep percolation and the consequent leaching of salts from the soil may be reduced. Surface runoff may be reduced, and consequently the loads of fertilizers, pesticides and sediment that are carried off the fields and into receiving water will be cut back. However, it has been the experience of scheduling services in the western United States that errors in the timing and amounts of irrigation do occur. In fact, such errors have been the rule rather than the exception. Even so, the findings of both an idealized study and a study conducted under real world conditions suggest that the benefits appear to be great enough for the government agencies charged with water quality management to give consideration to such programs. (Baker-FRC)
W83-01166

IT'S ALL DOWNHILL FROM HERE. THE EREWHON RURAL WATER SUPPLY SCHEME,
For primary bibliographic entry see Field 8A.
W83-01170

CONSERVATION TILLAGE EFFECTS ON WATER CONSERVATION,
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
J. M. Steichen, and R. W. LaForce.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139865,

Price codes: A03 in paper copy, A01 in microfiche. Completion Report, Kansas Water Resources Research Institute, Manhattan, September 1982. 22 p, 7 Fig, 4 Tab, 13 Ref. OWRT A-098-KAN(1), 14-34-0001-0118.

Descriptors: *Kansas, Wheat, Grain sorghum, Agricultural, Rainfall-runoff, *Water conservation, *Rainfall simulator, *Infiltration, Fallow cycle, *Tillage.

A portable rainfall simulator was built and calibrated to determine effects of tillage practices on infiltration. The rainfall simulator can vary the application rate between 0.5 and 13.6 cm/h at a nozzle pressure of 41 kPa. The choice of two nozzles allows droplet size and kinetic energy similar to low intensity or high intensity rainstorms. The use of a rainfall simulator to determine rainfall-runoff properties of a soil cover complex is practical. The rainfall simulator was used as a field unit on pasture at Manhattan, Kansas and wheat ground at Colby and Hays, Kansas. Tillage practices studied are no till, stubble mulch and clean till. Tests were run at various times in the wheat fallow or wheat sorghum fallow cycle. In general the field data tend to support the estimated curve numbers obtained by reducing published curve numbers up to 10% for residue cover. Although there is some variation due to deep tillage or large cracks, these are relatively short term and would be greatly reduced by the next significant rain. It appears that runoff estimates from stubble mulched areas in northwest Kansas by reducing curve numbers for residue cover are reasonable.
W83-01240

IRRIGATION FOR CROPS IN A SUB-HUMID ENVIRONMENT, I. THE EFFECT OF IRRIGATION ON THE GROWTH AND YIELD OF SOYBEANS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
G. A. Constable, and A. B. Hearn.
Irrigation Science, Vol 2, No 1, p 1-12, 1980. 5 Fig, 2 Tab, 18 Ref.

Descriptors: *Irrigation practices, *Crop yield, Farming, Water supply, Water demand, Vegetation, *Soybeans, Evapotranspiration, Water conservation.

Six irrigation treatments were imposed on two soybean cultivars grown on a grey cracking clay soil in two successive seasons. Irrigation treatments were Frequent (FF) - irrigation after 90 mm of calculated evapotranspiration (or 40% depletion of available moisture), Moderate (MM) - after 135 mm (60%), or Infrequent (II) - after 180 mm (80%) and NIL (rainfed). Two additional treatments, FM and MF, combined different irrigation frequencies before and after mid-flowering. Irrigation treatment II and NIL had less leaf area and total dry weight, but the distribution of dry weight between leaves, stems and pods was identical for all irrigation treatments in both seasons within a cultivar. It was found that net assimilation rate on a unit leaf area basis was less affected by irrigation treatment than was leaf expansion. Treatment FM had the greatest apparent redistribution of dry weight from leaves and stems to pods. Frequent irrigation during late flowering and pod filling was needed to ensure maximum yield in all seasons. It was concluded that one or two fewer irrigations could be applied during the vegetative phase than is the present commercial practice, and the water saved could be used to grow a larger area of crop. (Baker-FRC)
W83-01288

MOISTURE STRESS IN NAVY BEANS. I. EFFECT OF WITHHOLDING IRRIGATION AT DIFFERENT PHENOLOGICAL STAGES ON GROWTH AND YIELD,
Queensland Dept. of Primary Industries, Warwick (Australia).
J. L. Gunton, and J. P. Evenson.
Irrigation Science, Vol 2, No 1, p 49-58, 1980. 3 Fig, 5 Tab, 22 Ref.

Descriptors: *Moisture stress, *Crop yield, *Irrigation practices, Frosts, *Navy beans, Water supply, Moisture availability.

The effect of plant water stress imposed at all combinations of the three main phenological stages on the yield and growth of Navy beans was studied in field experiments at the Inglewood irrigation area of Queensland during the summers of 1971 and 1972. In 1972, a short, mild growing season with early frosts, yields varied with treatment from 0.55 to 1.52 t/ha. In 1972, a hotter growing season especially during the preflower stage but of normal duration, yields varied from 1.12 to 2.27 t/ha. Moisture stress imposed in the preflower and flowering stages in 1971 reduced yields by 28% and 24%, respectively. In 1972 moisture stress during the preflower stage reduced yield by 37% only if irrigation was also with held during the flowering stage. Moisture stress imposed during the flowering stage in 1972 reduced yields by 40%. Evaluation of the effects of moisture stress during the pod development stage was not possible due to early frosts in 1971 and rainfall in 1972. Yields were almost equally highly correlated with leaf area index and leaf area duration. Crop growth rate was similarly correlated with leaf area index. (Baker-FRC)
W83-01289

COMPUTER EVALUATION OF SPRINKLER IRRIGATION UNIFORMITY,
Kagoshima Univ. (Japan). Faculty of Engineering.
Y. Fukui, K. Nakanishi, and S. Okamura.
Irrigation Science, Vol 2, No 1, p 23-32, 1980. 11 Fig, 1 Tab, 5 Ref.

Descriptors: *Irrigation patterns, Evaluation, *Model studies, Irrigation, Water supply, Computers, Wind, *Sprinkler irrigation, Sprinklers, Sprinkling, Nozzles.

A method for evaluating the water application rate (WAR) and uniformity coefficient (Cu) of overlapping irrigation sprinklers is given for realistic field conditions, which include wind drift of the sprinkler spray. The method requires as input the geometry of the sprinkler arrangement, trajectories of water drops from the sprinkler nozzle as calculated by the equations of motion, and the WAR distribution (discharge) profile of a single sprinkler experimentally observed under windless conditions. Wind direction with respect to the main sprinkler line has a small effect on Cu and is assumed to be parallel to the main line. Results indicate that the wind drift effect of sprinkler spray on Cu can be neglected for wind velocities less than 1 m/sec. Analysis of simulated discharge profiles shows that the maximum value of the uniformity coefficient was obtained with triangular sprinkler discharge profiles at low values of spacing, changing to trapezoidal profiles as the spacing increases. The effect of nozzle pressure on WAR was evaluated for the pressure range between 294 and 490 kPa, and an optimum layout of overlapping sprinklers, designed to minimize the effect of wind drift and nozzle pressure on the uniformity of WAR distribution andCu to be calculated for sprinkler irrigation systems operating under practical operating conditions involving wind drift of sprays. (Baker-FRC)
W83-01290

IRRIGATION FOR CROPS IN A SUB-HUMID ENVIRONMENT, II. THE WATER REQUIREMENTS OF SOYBEANS,
University of New England, Armidale (Australia). Dept. of Agronomy and Soil Science.
For primary bibliographic entry see Field 2I.
W83-01314

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

INFLOW AND LEVELS OF THE CASPIAN SEA AND THEIR VARIATIONS UNDER THE EFFECT OF CLIMATIC FACTORS AND ECONOMIC ACTIVITY,
I. A. Shiklomanov, and V. Yu. Georgievskii.
Water Resources, Vol 8, No 5, p 465-476, September-October, 1981. 5 Fig, 2 Tab, 16 Ref. Translated from Vodnye Resursy, No 5, p 5-19, September-October, 1981.

Descriptors: *Economic development, *Mathematical models, *Water level fluctuations, *Long-term planning, *Sea level, *Dam effects, Mathematical models, Model studies, Evaluation, Coastal zone management, Future planning, Benefits, Projections, Seasonal variation, Surface runoff, *Caspian Sea.

A quantitative study was carried out of the changes in annual and seasonal runoff under the influence of economic activity of the main rivers emptying into the Caspian Sea. The normal inflow of river waters to the sea in 1880-1977 was 298 cu km/yr, with the effects of economic activity making the actual amount about 288 cu km/yr. The drop in sea level in the basin due to anthropogenic factors during 1932-1977 was about 1.4 meters. Because substantiated long range climatic predictions of sea level variations were not possible to make, a probabilistic variant calculation based on modeled series of the water-balance components of the sea was used to determine future sea level positions. Use of mathematical models showed that damming the Kara-Bogaz-Gol Gulf will help to maintain the sea level, as will diverting part of the runoff of northern rivers to the Volga. The maximum annual subsidies to the sea required in individual years to maintain the Caspian not below the -29.5 m mark may exceed 100 cu km. With additional water delivery of a maximum of 60 cu km/yr starting in 1991, it is estimated that future possible temporary decreases of the level below -29.5 m will last not more than 2 yr. (Geiger-FRC)
W83-01094

FENCES FOR FLOODWAYS,
Manawatu Catchment Board (New Zealand).
M. K. Holland.
Soil and Water, Vol. 16, No. 2, p 29-30, April, 1980. 3 Fig.

Descriptors: *Flood damage, *Fences, Construction, Maintenance, Flood protection, *New Zealand.

Collapsible fencing for berm lands is described. Of the many collapsible fences tried under flood conditions, two types have been collapsed and re-erected on numerous occasions and should give better than 15-20 years' life without too much maintenance. The collapsible fence Mark 1, which comes highly recommended, uses posts placed 14-16 m apart, 5-6 12.5 gauge high tensile wires, barb top and bottom, chain battens at 1.80 m centers and, where necessary, chains used as foot posts in dips. For erection, the top and bottom barbs are used as guide wires. While this procedure is unconventional and slower, it is necessary. A full 200 meters of fencing (about 15 posts) can be lowered in 10-15 minutes. A heavier fence is also described. (Baker-FRC)
W83-01148

ASWAN - DAM AND BE DAMNED.
Soil and Water, Vol 17, No 1, p 4-7, February, 1981. 4 Fig.

Descriptors: *Dams, *Environmental effects, *Farming, Nutrients, Irrigation, Nile River, Irriga-

tion canals, Canals, Aswan Dam, *Egypt, Leaching, Soil types, Clay.

The construction of the Dam at Aswan has brought about many changes in the quality and techniques used in farming in those areas, which formerly depended on mud and nutrients delivered yearly as the Nile flooded its banks. The area is now almost exclusively dependent on artificial fertilizers and ranks as one of the world's largest consumers in this market. The chemical fertilizer residues remain in the soil, causing a buildup of salinity, under conditions where the growing of highly demanding crops in rapid succession has already resulted in the soil becoming increasingly infertile. The soil is also gradually becoming clay-like and impervious. Recently, attempts have been made to carry out underground drainage. The reservoir created by the dam has an evaporation rate far greater than expected. There is also a problem with overgrowth of water hyacinths, huge numbers of water snakes, and abundance of snails which serve as hosts for flukes producing bilharzia in humans. On the positive side of the picture, agricultural production has almost doubled. Plans are being made to prepare a mud channel from the south end of the reservoir to below the old dam which will by-pass the high dam and convey the mud into the Nile once again. (Baker-FRC)
W83-01156

GRASS CARP AND WATER WEED,
Ministry of Agriculture and Fisheries (England). Fisheries Research Lab.
C. Mitchell.
Soil and Water, Vol 17, No 2, p 22-26, April, 1981. 1 Fig, 2 Ref.

Descriptors: *Aquatic weed control *Fish, Water quality, Reservoirs, Lakes, Stagnant water, *Grass carp, Carp, Weed control, Water supply development. *New Zealand.

Use of the herbivorous fish, the Chinese grass carp, to control water weeds has been investigated in static bodies of water at two sites, both isolated from other fresh waters. The study commenced in 1975. One site was the Waihi Beach Reservoir, with an area of 1.92 ha and a volume of about 40,000 cubic meters. The second trial site was Parkinsons's Lake, a eutrophic, 1.92 ha sand dune lake with an inflow from one temporary stream and direct runoff from the surrounding pasture. Findings indicated that populations of grass carp weighing more than 2 kg each are capable of virtually eliminating aquatic plant populations in static water under New Zealand conditions. The retention of some aquatic plant cover is desired to protect water quality and provide cover for fish and water fowl populations. Stocking densities will need to be adjusted so that optimum levels of weed control are attained. (Baker-FRC)
W83-01173

MAGNITUDE AND FREQUENCY OF FLOODS FROM SELECTED DRAINAGE BASINS IN SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
L. D. Becker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-237470, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 82-31, 1982. 90 p, 3 Fig, 4 Tab, 32 Ref.

Descriptors: *Floods, *Flood frequency, *Flood recurrence interval, *Flood peak, Flood forecasting, Surface water, Streamflow, Rainfall-runoff relationships, Gaging stations, Flood data, *South Dakota.

The 2-, 5-, 10-, 25-, 50-, and 100-year floods are determined for gaged sites on 120 selected, small drainage basins in South Dakota. These estimates are from the frequency curves defined from the streamflow records. Short-term records for 66 sites were extended on the basis of long-term climatic records and a rainfall-runoff model. These frequency curves may provide the best estimates of floods at these gaged sites. Analyses of flood-frequency information from these gaged sites have been the basis for techniques (published previously) used in estimating flood magnitude and frequency at ungaged sites in South Dakota. This report supplements flood-frequency information published earlier. It presents: Annual peak discharges colected during a 25-year period at 124 crest-stage partial-record stations; maximum observed and unit discharges determined for 124 crest-stage and 120 continuous-record gaging stations; updated flood-frequency curves for 120 crest-stage gages; a documentation of analytical procedures used; and a summary of the small-streams flood-peak data collection program in the State from 1955 to 1981. Maximum flood peaks determined at 244 partial- and continuous-record gaging stations and at 52 miscellaneous sites are compared with regional flood relationships. (USGS)
W83-01193

MODERNIZING IRRIGATION SYSTEMS IN ALBERTA,
Department of the Environment, Edmonton (Alberta). Div. of Design and Construction.
J. W. Thiessen, and R. F. Smith.
Canadian Journal of Civil Engineering, Vol. 9, No. 2, p 323-337, June, 1982. 11 Fig, 7 Tab, 19 Ref.

Descriptors: *Irrigation projects, *Regional development, *Semiarid lands, Water supply development, Water demands, *Alberta, Canada, Agriculture, Water resources development, *Irrigation systems.

Canadian experience in irrigation in the Province of Alberta is outlined, including the policies, procedures, and objectives that have been adopted to handle the financing and administration of a cost-sharing program designed to rehabilitate and expand the existing irrigation systems. Moisture is the limiting factor to crop production in Alberta. The history of irrigation in the area is described, along with methods of administration and cost-sharing arrangements. Operation and maintenance of irrigation distribution systems are considered, stressing capital works rehabilitation, improved layout of the system, conveyance efficiencies, technical guidelines, and irrigation expansion. Seepage control in irrigation canals is discussed, including buried membrane lining, concrete lining, interceptor drains, buried pipe systems, and other means of seepage control. Irrigation farming practices and river basin planning are discussed. Irrigation is the largest single water use in Southern Alberta; competition now exists for the limited water supply. Potentially irrigable land far exceeds the potential supply of water, and shortages occur during periods of low runoff or high demand. Planning studies call for the development of new storage facilities, upgrading existing distribution systems, and more efficient use of water. Great increases in development of irrigated agriculture could only occur with transfer of water from outside the basin. (Baker-FRC)
W83-01232

PASSAGE OF FLOODS OVER RIVER FLOODPLAINS,
For primary bibliographic entry see Field 2E.
W83-01233

SOLVING A DRAINAGE DITCH VEGETATION PROBLEM.
Public Works, Vol 113, No 9, p 84-85, September, 1982.

Descriptors: *Herbicides, *Drainage ditches, *Vegetation, Krenite, Hyvar XL, Drainage systems, Drainage canals, Clinton County, *Michigan, Maintenance, Weed control, Water management.

Control of woody vegetation clogging drainage canals in Clinton County, Michigan, features Krenite sprayed from a Ditch-Trol rig in late summer or early fall. The spray rig can treat up to 3 miles of dense brush in a day. This herbicide is registered for use on noncropland areas, including land adjacent to water bodies. Followup spot-gun treatments with Hyvar XL liquid controls resprouting stumps or escapes from previous treatments. The drainage system reconstruction began after a severe ice storm clogged the canals with fallen trees and brush. After accumulated debris and overgrowth were removed, the brush control program was established. In 1981 50 miles of the county's 800 miles of ditches were treated with Krenite or other suitable herbicides. (Cassar-FRC)
W83-01332

DRAINAGE IS THE BYWORD IN LOUISIANA PARISH.
Public Works, Vol 113, No 9, p 72-73, September, 1982.

Descriptors: *Drainage programs, *Water management, *Land reclamation, St. James Parish, *Louisiana, Drainage canals, Drainage ditches, Drainage engineering, Drainage networks, Drainage systems, Open-channel drainage.

In 1977 St. James Parish, Louisiana, launched a major drainage construction program which has resulted in over 100 miles of drainage structures, converting 6000 acres of swamp to farm and industrial sites. In-house construction crews are used whenever possible. Contractors are used for projects requiring unusually large equipment or when parish crews are unavailable. The drainage program for this flat, low-level gumbo mud area began with construction of 90 ft cross-section channels around the rim of the parish. Next, smaller primary and secondary ditches were dug to move the water to the largest channels. A maintenance program is aimed at keeping water in the large canals to prevent erosion and removing vegetation from smaller canals to prevent blockage. (Cassar-FRC)
W83-01348

4B. Groundwater Management

APPLICATION OF STATISTICAL METHODS TO FORECASTING OF NATURAL GROUNDWATER TABLES,
Morton and Partners Ltd., Rexdale (Ontario).
E. Zaltsberg.
Canadian Journal of Earth Sciences, Vol 19, No 7, p 1486-1491, July, 1982. 3 Fig, 3 Tab, 12 Ref.

Descriptors: *Forecasting, *Groundwater level, *Water table, *Statistical methods, Mathematical equations, Model studies, Drainage, Lithology, Saturation zone, Seasonal variations, Water supply, Water resources development.

Several statistical methods that can be used for forecasting the groundwater table regime are described. The choice of the method depends on: duration of observation period; hydrogeological conditions, especially degree of drainage and lithological contents of vadose and saturated zones; and duration of the lead period. In every case the least complicated forecasting equation with the minimum number of coefficients is the most reliable, especially for relatively short observation periods. It is noted that some of the methods described may be successfully used not only for forecasting but also for lengthening the groundwater observation period. (Baker-FRC)
W83-01108

A PRICING POLICY FOR GROUNDWATER MANAGEMENT IN PUERTO RICO,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
For primary bibliographic entry see Field 6C.
W83-01276

MUNICIPAL FRACTURED-ROCK WELLS,
For primary bibliographic entry see Field 3B.
W83-01350

NETWORK MODEL FOR OPTIMAL MANAGEMENT OF STREAM-AQUIFER SYSTEMS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
S. Phamwon.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146712, Price codes: A13 in paper copy, A01 in microfiche. PhD Thesis, 1982. 282 p, 37 Ref, 7 Tab, 76 Ref, 13 Append. OWRT B-201-COLO(4).

Descriptors: *Computer models, *Conjunctive use, *Aquifer management, *Hydrologic models, *Priorities, *Artificial recharge, Model studies, Water allocation, Return flow, Evapotranspiration, Groundwater storage, Surface storage, Water rights, Water management, *Colorado.

A computer model is presented for management of the conjunctive use of surface and subsurface storage in an interconnected stream-aquifer system. The model simultaneously stimulates the hydrologic system and optimizes the water allocation period by period. The model includes simulation of groundwater flow, subsurface storage, recharge and potential evapotranspiration. In order to demonstrate the usefulness of the model, a case study of the South Platte River section from the North Sterling inlet canal to the Julesburg gaging station in eastern Colorado was selected. The calibration results of the return flows to the river from several sources were satisfactory for the dry to average years but were less satisfactory for the wet years. The priorities of various demands obtained from the calibration were the same as the relative ranking of water rights of those demands. Two management alternatives were investigated. The first alternative considered artificial recharge to subsurface storage in addition to the current practices of the system. With this alternative, water is spread over areas chosen for artificial recharge areas during non-irrigation season months. With proper artificial recharge, it is unlikely that subsurface storage would be severely depleted due to heavy groundwater pumping during drought periods. The second groundwater management alternative studied the impact of changing downstream flow requirements governed by interstate compact agreement between Colorado and Nebraska. The results indicated that for the dry and average year conditions, any increase in the downstream flow would cause shortages in Colorado. (Moore-SRC)
W83-01366

4C. Effects On Water Of Man's Non-Water Activities

WOOD AND WATER,
For primary bibliographic entry see Field 6D.
W83-01171

STREAMFLOW AND WATER-QUALITY CONDITIONS, WILSONS CREEK AND JAMES RIVER, SPRINGFIELD AREA, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
W. R. Berkas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-226218, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 82-26, April, 1982. 38 p, 16 Fig, 11 Ref.

Descriptors: *Streamflow, *Water quality, *Urban runoff, *Effluents, Municipal wastes, Surface water, Water pollution effects, Water pollution sources, *Missouri, Springfield, Wilsons Creek, James River.

A network of water-quality monitoring stations was established upstream and downstream from the Southwest Wastewater-Treatment Plant on Wilsons Creek to monitor the effects of sewage effluent on water quality. Data indicate that 82 percent of the time the flow in Wilsons Creek upstream from thee wastewater-treatment plant is less than the effluent discharged from the plant. On October 15, 1977, an advanced wastewater-treatment facility was put into operation. Of the four water-quality indicators measured at the monitoring stations (specific conductance, dissolved oxygen, pH, and water temperature), only dissolved oxygen showed improvement downstream from the plant. During urban runoff, the specific conductance momentarily increased and dissolved-oxygen, concentration momentarily decreased in Wilsons Creek upstream from the plant. Urban runoff was found to have no effect on specific conductance and dissolved oxygen downstream from the plant before or after the addition of the advanced wastewater-treatment facility. Data and collected monthly from the James River showed that the dissolved-oxygen concentrations and the total nitrite plus nitrate nitrogen concentrations increased, whereas the dissolved-manganese concentrations decreased after the advanced wastewater-treatment facility was implemented. (USGS)
W83-01192

4D. Watershed Protection

PREVENTING EROSION, LANDSLIP AND FLOODING, A PLANNING APPROACH,
Ministry of Works and Development (New Zealand).
For primary bibliographic entry see Field 6F.
W83-01147

THE TE AWA RESEARCH: 35 YEARS OF SOIL CONSERVATION,
F. E. T. Suckling.
Soil and Water, Vol 16, No 5, p 16-20, October, 1980. 17 Fig.

Descriptors: *Soil conservation, *Flood control, *Erosion control, Rainfall, Vegetation establishment, Te Awa, Catchment areas, *New Zealand, Dams, Gully erosion, Gullies, Ravines.

Early research on soil conservation conducted on a hill country farm 30 km north of Palmerston North (New Zealand) is reviewed 35 years later. In 1945 the Soil Conservation and Rivers Control Council leased an area of hill country for soil conservation studies. Gully control experiments were based on debris dam construction techniques, but with the use of live poles. The great weakness and danger evident in the structures of the dams appeared to be scouring on this easily eroded soil. After an unusually heavy storm in 1949, a second approach was tried. This alternative appeared to be either soundly engineered concrete structures, where the energy of the water is dissipated by mechanical an structural devices, or a process of new gully alignment using bulldozers to restore the broad grassed runways which existed before the gullies washed out. The plan was made to flatten out the gully floor with a bulldozer to form a broad U and then grass it over. In spite of heavy seeding, topdressing and favorable weather conditions, establishment was poor and growth slow. A concrete spillway was eventually constructed in 1945. Mass tree plantings each winter began to take effect from 1949 onwards. Over the years grassland improvement has proved to be the most successful aspect of the work at Te Awa. (Baker-FRC)
W83-01169

EROSION, REDEPOSITION, AND DELIVERY OF SEDIMENT TO MIDWESTERN STREAMS,
Arizona Univ., Tucson. School of Renewable Natural Resources.
D. C. Wilkin, and S. J. Hebel.
Water Resources Research, Vol 18, No 4, p 1278-1282, August, 1982. 2 Tab, 17 Ref.

Descriptors: *Erosion control, *Sediment transport, *Floodplains, Cropping, Vegetation, Watersheds, Sediments, Sedimentation, Streams, Water quality, Watershed management, *Illinois, Middle-forks River, Forest watersheds.

Sediment movement patterns were studied in a midwestern watershed using fallout cesium-137 techniques. The data obtained were insufficient to give any clear indication of sediment delivery ratios to be expected from the various upland landscape positions. The little evidence gathered indicates that much of the erosion is intercepted by upland depressions, grassed field borders, fencelines, hedgerows, and roadside ditches. Far more upland sampling will need to be done in areas with differing topography, soils, and cropping systems. Cropped borderlands which were isolated from the floodplains by wooded areas, while eroding at high rates, seemed to be delivering sediment to the active floodplain at an attenuated rate, depending on the width of the intervening woodland. the contribution of floodplains to the sediment problems depends distinctly on management. Likewise, the steep borderlands adjoining the floodplains, if not cropped, not only erode at excessive rates but deliver virtually all such erosion to the active floodplain unless a forested buffer intervenes. (Baker-FRC)
W83-01203

SOIL CONSERVATION PROTECTS THE TROUT,
Waikato Valley Authority, Hamilton (New Zealand).
K. Young.
Soil and Water, Vol 16, No 3, p 7-8, June, 1980. 1 Fig.

Descriptors: *Fish, *Soil conservation, *Erosion control, Catchment areas, Conservation, Lake Taupo, Waikato Valley, Whangamata Catchment, *New Zealand, Trees, Stream banks.

The Waikato Valley Authority (New Zealand) was approached by landowners and by the Department of Internal Affairs with a view to formulating a proposal for conservation works in the Lake Taupo and Whangamata catchment areas. Work began in February of 1976 to reduce rising sediment loads by controlling the various types of erosion within the catchment, revitalizing the stream as a trout spawning habitat, enhancing birdlife within retired areas, assisting farm management, and protecting land and water resources within this area in perpetuity. In 1961, before land development and consequent erosion took place, a fish trap was placed in the Whangamata Stream; total run figures for the period 1 June to 7 September were 2049. A similar trap was installed in 1979, with a total run of 3258 trout. Unofficial estimates indicate that for the spawning period of 1975 there might have been fewer than 80 spawning trout. In the process of mitigating sediment loads and controlling erosion in this catchment, trout spawning has been revitalized, birdlife habitats are enhanced, farm management has benefited, and the land and water resources have been protected. (Baker-FRC)
W83-01294

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

EXTRACTABLE ORGANIC MATTER IN MUNICIPAL WASTEWATERS. 2. HYDROCARBONS: MOLECULAR CHARACTERIZATION,
California Univ., Los Angeles. Dept. of Earth and Space Sciences.
R. P. Eganhouse, and I. R. Kaplan.
Environmental Science and Technology, Vol 16, No 9, p 541-551, 1982. 7 Fig, 2 Tab, 59 Ref.

Descriptors: *Water analysis, *Municipal wastewater, *Organic compounds, Petroleum industry, Oils, Leaching, Infiltration, Fate of pollutants, Path of pollutants, Environmental effects.

High-resolution gas chromatography and computer assisted gas chromatography-mass spectrometry were used to analyze hydrocarbons isolated from southern California municipal wastewaters. Most of the hydrocarbons, 56-77%, were not chromatographically resolvable and probably derive from petroleum products such as lubricating oils. Normal, iso-, and acyclic isoprenoid alkanes along with alkylcyclohexanes and numerous series of substituted benzenes and polycyclic aromatic hydrocarbons compose the major fraction of the resolvable hydrocarbons. Polycyclic terpenoids occur as trace constituents and appear to be of ancient origin. Locally produced petroleum was, at most, only a minor contributor to these

wastewaters. A homologous series of long-chain alkylbenzenes presumably derived from the LAS-type detergents was identified. These compounds seem abundant and ubiquitous domestic wastewater constituents that may be exploited as anthropogenic waste tracers in the marine environment. (Baker-FRC)
W83-01077

ON THE USE OF THE NEPHELOMETER IN ESTUARINE WATERS,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
A. Eaton, V. Grant, O. Bricker, and D. Wells.
Estuaries, Vol. 4, No. 4, p 379-384, December, 1981. 4 Fig, 2 Tab, 21 Ref.

Descriptors: *Estuaries, *Suspended sediments, *Sampling, *Pollutant identification, *Nephelometer, Turbidity, *Chesapeake Bay, Particle size.

A guide for sampling suspended sediments at vertical profiles in an estuary featuring nephelometer readings is described. Data was obtained during two Chesapeake Bay cruises in 1979. Two generalizations were apparent from the results. Variations in nephelometer responses were much greater between stations than within stations, with higher load/response ratios near the upper estuary than in the lower estuary. Within a given station there were systematic variations in the ratio, with bottom samples having higher ratios than surface samples. Coulter Counter determination of particle sizes confirmed that load/response ratios reflected changes in particle size, allowing a separation of different sources of sediment load such as fines in a background load and coarser material present intermittently. A sampling procedure which decreases filtration requirements by a factor of 2 is described. First a water sample for filtration (calibration) and a nephelometer reading are taken near the bottom. Nephelometer readings are taken through the water column. Whenever readings change by 10-15%, another calibration is done. The ratio of load in mg per liter to nephelomter readings is tabulated for all calibrated samples, and weights between calibration points are interpolated. (Cassar-FRC)
W83-01135

CHEMICAL STUDIES OF COPPER-ORGANIC COMPLEXES ISOLATED FROM ESTUARINE WATERS USING C18 REVERSE-PHASE LIQUID CHROMATOGRAPHY,
Rhode Island Univ., Kingston, Graduate School of Oceanography.
G. L. Mills, A. K. Hanson, Jr, J. G. Quinn, W. R. Lammela, and N. D. Chasteen.
Marine Chemistry, Vol. 11, No. 4, p 355-377, 1982. 6 Fig, 5 Tab, 30 Ref.

Descriptors: *Copper, *Organic matter, *Chelation, *Pollutant identification, *Narragansett Bay, *Rhode Island, *Chromatography, Chemical reactions, Seawater.

Reverse-phase liquid chromatography with C18 Sep-Pak cartridges was used for isolating dissolved organic matter (DOM) and dissolved copper-organic complexes from estuarine waters of Narragansett Bay, Rhode Island. The cartridges retained organic matter and Cu with constant efficiency from samples up to about 1 liter in volume. The isolated materials were eluted from the column with water; methanol mixtures of increasing methanol proportions to obtain six fractions. The 70:30 water: methanol mixture produced one fraction of organic matter with copper activity 6 times greater than the overall activity for the DOM. Chromatographic analysis of this fraction indicated an intermediate polarity and appreciable aromatic character. Other investigations showed that most of the Cu was associated with acidic sites on the DOM and that the binding sites probably involved oxygen donor ligands. Ultraviolet radiation of seawater for 6 hours destroyed 77% of the Cu-organic complexes but only 37% of the DOM. Studies of the exchange of Cu64 with the binding sites indicated that 70% of the sites readily exchanged with copper in seawater and 20% of the sites were essentially inert to exchange. (Cassar-FRC)
W83-01139

ANIONIC SURFACTANT CONCENTRATION IN THE RIVER AND SEA WATERS OF HYOGO PREF. AND ITS RELATIONSHIP TO PHOSPHORUS CONCENTRATION, (IN JAPANESE),
Hyogo Prefecture Environmental Science Inst., Kobe (Japan).
For primary bibliographic entry see Field 5B.
W83-01152

GROUND WATER GEOCHEMISTRY OF 228RA, 226RA, AND 222RN,
South Carolina Univ., Columbia. Dept. of Geology.
P. T. King, J. Michel, and W. S. Moore.
Geochimica et Cosmochimica Acta, Vol 46, No 7, p 1173-1182, July, 1982. 5 Fig, 3 Tab, 21 Ref. OWRT B-127-SC.

Descriptors: *Groundwater, *Geochemistry, *Radium, *Radon, Thorium, Uranium, *South Carolina, Radioisotopes, Water analysis, Chemical analysis, Chemical reactions.

The distribution of two intermediate nuclides of the U-228 decay series, RA-226 and Rn-222 and the immediate daughter of Th-232, Ra-228, was investigated in the ground water of South Carolina. Over 150 groundwater samples were collected from drilled, public water supply wells. A wide range of aquifer lithologies was sampled, including the crystalline rocks of the Piedmont and sedimentary deposits of the Coatal Plain. A significant linear relation was noted between log Ra-228 and log Ra-226 in the Piedmont and Coastal Plain ground waters. Median Ra-228/Ra-226 activity ratios for the Piedmont, 1.2, and Coastal Plain, 1.3, groundwater were close to estimated average crustal Th-232/U-238 activity ratios of 1.2 to 1.5 corresponding to Th/U weight ratios of 3.5 to 4.5. A linear correlation was also noted between log Rn-222 and long Ra-226 for Piedmont and Coastal Plain groundwater. However, the median Rn-222/Ra-226 activity ratio for Piedmont groundwater, 6100, was much higher than for Coastal Plain groundwater, 230. Higher excess Rn-222 activities may be due to greater retention of Ra-226 by the chemically active Piedmont aquifers compared to the more inert sand aquifers sampled in the Coastal Plain. The relationship between log Ra-228 and log Ra-226 was used to predict total Ra distributions in Appalachian and Atlantic and Gulf Coastal Plain groundwater. Predictions estimate that 2.4% of Appalachian and 5.3% of Atlantic and Gulf Coastal Plain groundwater supplies contain total Ra activities in excess of the 5 pCi/liter limit established by the US EPA. These predictions also indicate that 40-50% of these groundwater wells may be overlooked using the presently suggested screening activity of 3.0 pCi/liter of Ra-226 for Ra-228 analysis. (Baker-FRC)
W83-01157

EVALUATION OF A PERSULFATE DIGESTION METHOD FOR PARTICULATE NITROGEN AND PHOSPHORUS,
Georgia Univ., Athens, Inst. of Ecology.
C. L. Langner, and P. F. Hendrix.
Water Research, Vol 16, No 10, p 1451-1454, October, 1982. 3 Tab, 19 Ref.

Descriptors: *Water analysis, *Nutrients, *Digestion, *Persulfates, *Phosphorus, *Nitrogen, Particulates, Natural waters, Leaves, Digestion method, Pollutant identification, Periphyton.

A persulfate digestion method for particulate nitrogen and phosphorus in aufwuchs suspensions was tested on two types of dried materials and samples from a freshwater microcosm. The dried materials included orchard leaves and aufwuchs. Recoveries ranged from 80-100%, depending on the reference material composition, and coefficients of variation were from 1.3 to 26.8% for nitrogen and 0.3 to 9.3% for phosphorus. The maximum recovery of both nitrogen and phosphorus from the aufwuchs material occurred in samples containing 300-400 mg persulfate. This suggests an optimum persulfate to sample weight ratio of about 200-250 for the conditions used in this study. The ease of the persulfate digestion is a major advantage over the Kjeldahl procedure. The method is at least as efficient as the analytical procedures to which it has been compared. However, it is noted that sizable internal stores of nitrate-nitrogen in algal tissue would result in higher nitrogen values for persulfate compared to Kjeldahl. Therefore, unless corrections can be made, this value should be considered as representing total nitrogen rather than total organic nitrogen. (Baker-FRC)
W83-01196

EFFECT OF CONTAINER TYPE ON PH AND ALKALINITY STABILITY,
Municipal Environmental Research Lab., Cincinnati, OH.
M. R. Schock, and S. C. Schock.
Water Research, Vol 16, No 10, p 1455-1464, October, 1982. 10 Fig, 6 Tab, 17 Ref.

Descriptors: *Water analysis, *Sample preservation, Water sampling, Preservation, Sampling, *Alkalinity, Acidity, *Hydrogen ion concentration, Pollutant identification.

Efforts were made to develop a simple, inexpensive methodology which can adequately preserve the pH and alkalinity of samples for a long enough period of time to allow substitution of analytical values obtained in a laboratory for those that otherwise would have to be obtained by field personnel. Several container and cap combinations were evaluated for their ability to preserve the pH and alkalinity of test waters that were out of equilibrium with atmospheric carbon dioxide over time periods representative of mail or other surface transport. Provided that no air bubbles were present when the sample bottle was filled and sealed, polyvinyl chloride bottles with caps having a conical polyethylene insert yielded the most satisfactory results. High density linear polyethylene bottles were also generally satisfactory. Cap design was noted to be very important. Guidelines for analysis and preservation are given and, if they are followed, laboratory measurements can be reliably substituted for field measurements in many instances. (Baker-FRC)
W83-01197

DETERMINATION OF TOTAL KJELDAHL NITROGEN AND TOTAL PHOSPHORUS IN SURFACE WATERS AND WASTEWATERS,
Wisconsin State Lab. of Hygiene, Madison.
G. T. Bowman, and J. J. Delfino.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1324-1330, September, 1982. 14 Tab, 16 Ref.

Descriptors: *Water analysis, *Nitrogen, *Phosphorus, Wastewaters, Natural waters, Rivers, Lakes, *Kjeldahl nitrogen, Nutrients, Spectrophotometry, Automation, *Pollution identification.

The Wisconsin State Laboratory of Hygiene technique for determining total Kjeldahl nitrogen and total phosphorus in surface and waste waters is described, and a comprehensive evaluation of data obtained over three years of routine use is presented. By modifying certain procedural details employed in a previously presented method, the present technique allows considerably increased routine sample analytical capacity compared with manual methods. Increased precision is also noted for both the TKN and P semiautomated procedures, whereas improved accuracy (recovery) is noted for TKN measurements using nicotinic acid as a standard. The digestion procedure was modified by adding an additional BD40 block digestor, increasing the maximum sample volume from 10to 20 ml, increasing the digestion temperature from 370 to 380 C, and increasing the digestion time at 380 C from 30 to 75 min. (Baker-FRC)
W83-01210

TIME-DEPENDENT VARIATION OF MERCURY IN A STREAM SEDIMENT AND THE

EFFECT UPON MERCURY CONTENT IN GAMMARUS PULEX (L.),
Aarhus Univ. (Denmark). Zoologisk Inst.
P. Kristensen.
Water Research, Vol 16, No 6, p 759-764, June, 1982. 6 Fig, 2 Tab, 20 Ref.

Descriptors: *Mercury, *Bottom sediments, Sediments, *Amphipods, *Gammarus, Variability, *Organic matter, Water pollution effects, Pollutant identification.

The objectives of this study were to investigate the variability of mercury as related to the variation of organic matter in the sediment and to investigate a possible relation between content of mercury in Gammarus pulex (L.) and the sediment. An investigation was carried out over the three months in a stream environment. A positive correlation was noted between the organic content and the mercury content of the sediment samples. The mean mercury concentration in the organic fraction can be read from the regression line. During the study period a very high fluctuation was found in the mercury content of analyzed Gammarus pulex. The phenomenon may be explained through fluctuations in the methylating processes within the sediment. No positive correlation was found between mercury in Gammarus pulex and in sediment samples taken from identical locations. (Baker-FRC)
W83-01212

USE AND LIMITATIONS OF SEDIMENTARY PIGMENTS AS INDICATORS OF PAST LAKE PRODUCTIVITY,
Massachusetts Univ., Amherst. Dept. of Zoology.
S. D. Ludlam.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139683, Price codes: A04 in paper copy, A01 in microfiche. Publication No 127, Water Resources Research Center, University of Massachusetts, Amherst, June, 1982. 63 p, 6 Fig, 7 Tab, 43 Ref. OWRT B-068-MASS(1), 14-34-0001-9117.

Descriptors: Limnology, *Lake Morphology, *Eutrophication, *Aquatic productivity, *Lake sediments, Sediments, Pollution load, Lake Basins, Life history studies, *Massachusetts, Lakes.

The horizontal distribution of sedimentary pigments was investigated in 6 Massachusetts lakes, 4 in the Berkshire Hills and 2 on Cape Cod. The concentration of sedimentary chlorophyll and carotenoids in the most surficial sediment was directly related to sestonic chlorophyll a, water depth and length of hypolimnetic anoxia. The occurrence of an abundant littoral flora increased shallow water sedimentary pigment concentration but had little effect on deep water sediment in these lakes. The above relationships were used in interpreting the history of lake productivity from 1 m long sedimentary pigment profiles in 5 of the 6 lakes. In only one case, Duck Pond on Cape Cod, was there a close correlation between increased productivity and the onset of European settlement. In two other lakes productivity began to increase long before European settlement. Generally, productivity declined soon after settlement. Evidence for significant, recent, cultural eutrophication was found only for Stockbridge Bowl in the Berkshire Hills and for Duck Pond.
W83-01237

WHAT'S IN THE WATER,
J. Bathurst, L. J. Thomson, and L. F. Wilkinson.
Soil and Water, Vol 17, No 3, p 20-21, June, 1981. 2 Fig.

Descriptors: *Water quality, *Water analysis, *Well water, Drinking water, Wells, Water pollution sources, *New Zealand, Christchurch, *Groundwater, Sampling, *Bromide, *Chloride, Pollutant identification, Ions.

Groundwater in a 25 x 17 km area west of Christchurch, New Zealand, covering the recharge zone of the aquifer along the Waimakariri River to the Rolleston-Prebbleton area was sampled from May to August 1978. There are about 600 wells in the area, drawing water mainly from unconfined aquifers. The concentrations of bromide and chloride ions increased rather uniformly with increasing distance from the Waimakariri River. Specific known sources of ions, such as sites of irrigation of farm or industrial wastes, did have a local effect on the groundwater quality, but the effect was usually quickly lost through dilution. Bromide ions in general appeared in a constant ratio with chloride ions and thus there was no evidence for sustained and widespread elevated bromide levels being due to the discharge of bromide-containing industrial wastes, particularly in the Prebbleton area. Levels of bromide are very low and present no risk to health. (Baker-FRC)
W83-01292

AUTOMATED PREVALVE SAMPLE FILTRATION IN FLOW INJECTION ANALYSIS: DETERMINATION OF SULPHATE IN WATER REMOVING SUSPENDED SOLIDS AND COLOUR BEFORE SAMPLING,
Pretoria Univ. (South Africa). Dept. of Chemistry.
J. F. van Staden.
Fresenius' Zeitschrift fur Analytische Chemie, Vol 312, No 5, p 438-440, 1982. 1 Fig, 4 Tab, 2 Ref.

Descriptors: *Water analysis, *Spectrophotometry, *Measuring instruments, Sampling, Flow injection analysis, *Sulfate, Suspended solids, Color, Pollutant identification.

An automated flow-injection procedure is proposed in which the interference caused by suspended solids and the presence of organic substances and color are automatically removed by using an active carbon filter, which is incorporated in the flow system between the sampler and the sampling valve system. With this automated prevalve sample filter the proposed turbidimetric method gives the same results as a standard flow injection and an automated segmented method where the above mentioned interferences are manually removed prior to sampling. The method is applicable for the analysis of sulfate in surface, ground the domestic waters in the concentration range up to 200 mg/l at a sampling rate of up to 60 samples per hour with a coefficient of variation of better than 1%. (Baker-FRC)
W83-01303

QUANTITATIVE DETERMINATION OF VOLATILE HALOGENATED HYDROCARBONS IN WATER SAMPLES BY CAPILLARY GAS CHROMATOGRAPHY AND ELECTRON CAPTURE DETECTION,
Tuebingen Univ. (Germany, F.R.). Inst. fuer Organische Chemie.
H. Hagenmaier, G. Werner, and W. Jager.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 15, No 4, p 195-198, August, 1982. 4 Fig, 2 Tab, 6 Ref.

Descriptors: *Chlorinated hydrocarbons, *Organic compounds, *Water analysis, *Pollutant identification, Chloroform, *Halogenated compounds, Chromatography, *Gas chromatography, Tubingen, *Germany, Lake Constance.

Volatile halogenated hydrocarbons were determined in water samples by liquid-liquid extraction with pentane and capillary gas chromatography. The problem of differences in extraction efficiency among the individual compounds was eliminated by using a standard solution containing the internal standard, 1-bromobutane, for calibration. This was equilibrated with water in the same ratio as used in the sampling procedure. Water samples from the Tuebingen municipal water supply and from Lake Constance were analyzed. Tuebingen water was higher in 1,1,2-trichloroethane (0.05 micrograms per liter), carbon tetrachloride (0.04 micrograms per liter), trichloroethylene (14.73 micrograms per liter), chlorodibromomethane (0.48 micrograms per liter), tetrachloroethylene (3.48 micrograms per liter), and bromoform (0.77 micrograms per liter). Lake Constance water was higher in chloroform (0.96 micrograms per liter) and dichlorobromomethane (1.05 micrograms per liter). Standard deviations for calibration mixtures corresponding to 0.4-8 micrograms per liter of each compound were 0.012-0.031 micrograms per liter; for water samples, 0.023-0.036 micrograms per liter. The detection limit was about 0.005 micrograms per liter. (Cassar-FRC)
W83-01338

A MICROPROCESSOR CONTROLLED SYSTEM FOR STORM WATER SAMPLING (EIN MIKROPROZESSOR-GESTEURTES SYSTEM ZUR PROBENNAHME AUS REGENEASSERKANALEN),
Hanover Univ. (Germany, F.R.). Inst. fuer Wasserwirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau.
For primary bibliographic entry see Field 7A.
W83-01342

A PILOT STUDY OF POTENTIAL PHENOLIC CONTAMINATION OF FISHES IN THE COLUMBIA RIVER AND TRIBUTARIES IN THE VICINITY OF MOUNT ST. HELENS,
Beak Consultants, Inc., Portland, OR.
For primary bibliographic entry see Field 5C.
W83-01354

RELATIONSHIPS BETWEEN CANDIDA ALBICANS AND TRADITIONAL BACTERIAL INDICATORS OF POLLUTION IN WASTEWATER AND RECEIVING WATERS,
Connecticut Univ., Storrs. Inst. of Water Resources.
D. M. Hedden.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146670, Price codes: A04 in paper copy, A01 in microfiche. MS Thesis, 1982. 72 p, 14 Fig, 10 Tab, 97 Ref. OWRT A-085-CONN(3).

Descriptors: *Water pollution indicators, *Yeast, *Wastewater pollution, *Candida, *Chlorination, Wastewater treatment, Effluents, Streptococcus, Water quality, Pathogenic fungi, Coliforms, Hydrogen ion concentration.

Candida albicans is a yeast and an opportunistic pathogen which is present in domestic wastewater and receiving water. Significant correlations were found between the traditional fecal indicators and C. albicans in wastewater. The correlation between C. albicans and the fecal streptococci was higher than the correlations between C. albicans and either the total or fecal coliforms. No significant correlations were found between C. albicans and any of the indicators in receiving water. Candida albicans was capable of extended survival in filtered raw sewage, river water, and distilled water; survival capability was significantly lower in sea water. Candida albicans survived exposure to moderte levels of chlorine; pH was a significant factor in these experiments. Three possible applications for the use of C. albicans as an indicator of water quality are (1) special problem studies of effluent discharge, (2) as a complimentary indicator for recreational water and pool use, and (3) as a chlorine resistant indicator.
W83-01362

REFINEMENT OF THE IDENTIFICATION AND SPECIATION SCHEMES OF FECAL STREPTOCOCCI,
Northern Arizona Univ., Flagstaff. Dept. of Microbiology.
A. M. Hekmati.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-147884, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis, June 1981. 122 p, 3 Fig, 37 Tab, 22 Ref. OWRT A-096-ARIZ(2), 14-31-0001-0103.

Descriptors: *Streptococcus, *Bacterial analysis, *Microbiological studies, *Fecal pollution indicators, Water pollution, *Pollutant identification, Feces, Specification, Bacterial identification, Bioindicators, ATCC standards.

The EPA Schemes of identification and speciation of fecal streptococci were evaluated against nine standard streptococci obtained from the American Type Culture Collection (ATCC). The results of

the biochemical tests were found to be contrary to those expected from the schemes. As an alternate method of speciation a number of carbohydrate fermentation tests were done using the EPA guidelines. Although it was not possible to separate the standard organisms following the guidelines, two of the standard organisms were found to be the same since they produced identical fermentation test results as well as having an identical colonial morphologies. Several tests were found to be useful in the confirmation of the fecal streptococcus group. These included: gram stain reaction, cellular morphology, colonial morphology on KF-Streptococcal Agar, thermal resistance, and negative catalase test. Results of these tests were found to be common to all the standard fecal streptococci as well as all of the environmental isolates. Also, a speciation method based on carbohydrate discs and phenol red agar plates made it possible to speciate all of the standard organisms as well as the environmental isolates. The disc method is simple, more economical, and requires less time than the method proposed by the EPA.
W83-01365

VARIATION OF TRACE ELEMENT CONCENTRATION IN RAINWATER WITH RAINFALL RATE AND RAINFALL AMOUNT,
Bhabha Atomic Research Center, Bombay (India). Air Monitoring Section.
S. Sadasivan.
Mausam, Vol 31, No 2, p 222-224, April, 1980. 2 Fig, 16 Ref.

Descriptors: *Trace elements, *Rainwater, *Rainfall rate, *Water pollution sources, Monsoon, Chemistry of precipitation, *India, Iodine, Potassium, Bromine, Sodium, Chloride, Calcium, Magnesium.

Variations in the trace element concentrations in rainwater at Bombay and Lonavala are presented and discussed in relation to rainfall amount and rate. Collections were made during monsoon conditions. The results confirm the known inverse relation between concentration and rainfall rate as well as rainfall amount. The decrease in concentration with rainfall rate is related to increasing drop diameter and liquid water content of the precipitating cloud. The effect of washout on the trace element concentration in rainwater is not significant. The maximum to minimum concentration ratio is significantly less for I, K, and Br as compared to other elements such as Na, Cl, Ca, or Mg. (Baker-FRC)
W83-01379

CONTINUOUS MONITORING OF TOTAL AND INORGANIC MERCURY IN WASTEWATER AND OTHER WATERS,
Nagoya Univ. (Japan). Dept. of Engineering.
M. Goto, T. Shibakawa, T. Arita, and D. Ishii.
Analytica Chimica Acta, Vol 140, No 1, p 179-185, 1982. 7 Fig, 5 Ref.

Descriptors: *Monitoring, *Water quality, *Mercury, *Measuring instruments, *Spectrometry, Atomic absorption spectrometry, Chemical oxygen demand, Phosphorus, Nitrogen, *Water analysis, Automation.

An automated continuous monitoring system is presented for the determination of total as well as inorganic mercury by cold-vapor atomic absorption spectrometry. The method uses continuous flow digestion, reduction and extraction in small bore tubes at slow flow rates, and is suitable for use in the analysis of wastewater and natural waters. A detection limit of 0.1 ppb is obtained when a specially designed, complete gas-liquid separator is used, with a condenser circulated with ice-chilled water for removing water vapor and an 8-microliter flow cell for detection. The response times for the determination of inorganic and total mercury are about 3 and 5 minutes, respectively. The amount of reagents required is about one-tenth of that in conventional Auto-Analyzer methods. (Baker-FRC)
W83-01380

COMPARISON OF CONTINUOUS EXTRACTORS FOR THE EXTRACTION AND CONCENTRATION OF TRACE ORGANICS FROM WATER,
Dow Chemical Co., Midland, MI.
T. L. Peters.
Analytical Chemistry, Vol 54, No 11, p 1913-1914, 1982. 1 Fig, 1 Tab, 1 Ref.

Descriptors: *Water analysis, *Trace organics, *Extraction, Concentration, Measuring instruments, Continuous liquid-liquid extractors, Steam codistillation extractor, Steam distillation extractor, Flow under extractor, Flow over extractor.

A comparison was made to determine what extractors will best handle certain problems. The following extractors were considered in the evaluation: liquid-liquid extractor, steam codistillation extractor, steam distillation extractor, flow under extractor, and flow over extractor. For general use the SCDE and FUE/FOE appeared to be the most useful. In general purpose work where the aim is to extract everything possible with the solvent being used, the FUE/FOE would be optimum. When more specificity and a cleaner extract are desired, the SCDE can be used provided adequate precautions are taken to cover, for example, thermal stability and foaming problems. (Baker-FRC)
W83-01381

INFLUENCE OF KINETICS ON THE DIRECT TITRATION CURVES OF NATURAL WATER SYSTEMS - THEORETICAL CONSIDERATIONS,
Institut Rudjer Boskovic, Zagreb (Yugoslavia). Center for Marine Research.
I. Ruzic, and S. Nikolic.
Analytica Chimica Acta, Vol 140, No 1, p 331-334, 1982. 3 Fig, 4 Ref.

Descriptors: *Kinetics, Natural waters, *Titration, *Trace metals, *Copper, *Water analysis, Complex formation, Chemical reactions.

The effect of the rate of complex formation on the titration curves of natural waters with traces of metals is calculated. The effect can be distinguished from multiple complex formation. The problem of trace metal speciation has always been investigated by direct titration with a trace metal under conditions where equilibrium was not attained. The theoretical predictions presented in this study about the influence of the kinetics of complex formation on such titration curves should aid in the achievement of accurate results in cases where equilibrium is established. The procedure for the determination of metal-binding capacity suggested herein cannot be significantly affected by the kinetics of complex formation, which plays an important role only at free copper concentrations less than 20 micrograms/cubic dm. (Baker-FRC)
W83-01388

SPECTROPHOTOMETRIC DETERMINATION OF ALUMINUM IN RIVER WATER WITH BROMOPYROGALLOL RED AND N-TETRADECYLTRIMETHYLAMMONIUM BROMIDE BY FLOW INJECTION ANALYSIS,
Technical Univ., Lodz (Poland). Inst. of General Chemistry.
C. Wyganowski, S. Motomizu, and K. Toei.
Analytical Chimica Acta, Vol 140, No 1, p 313-317, 1982. 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Aluminum, *Water analysis, *Spectrophotometry, Rivers, Natural waters, Flow injection analysis, Measuring instruments, Bromopyrogallol red, Tetradecyltrimethylammonium bromide, *Japan, Asahi River, Yoshii River, Takahashi River.

A sensitive spectrophotometric method for the determination of aluminum with bromopyrogallol red in the presence of n-tetradecyltrimethylammonium bromide has recently been proposed and applied to the determination of micro amounts of aluminum in natural waters. The present study describes the adaptation of this spectrophotometric reaction to flow injection analysis for the determination of aluminum in river waters. In the proposed system, the reagent solution contains bromopyrogallol red, n-tetradecyltrimethylammonium bromide and hexamine in 60% ethanolic solution, and the carrier solution contains acetate buffer, 1,10-phenanthroline and hydroxylammonium chloride. Sample solutions acidified by sulfuric acid are injected, and the peak absorbance at 623 nm is recorded. The detection limit is about 0.001 ppm, and calibration plots are linear for the ranges 0-0.3 and 0-0.1 ppm aluminum. (Baker-FRC)
W83-01389

5B. Sources Of Pollution

THE INFLUENCE OF ATMOSPHERIC NITROGEN INFLUX UPON THE STREAM NITROGEN PROFILE OF A RELATIVELY UNDISTURBED FORESTED WATERSHED,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
J. R. Nuckols, and I. D. Moore.
Journal of Hydrology, Vol 57, No 1/2, p 113-135, May, 1982. 3 Fig, 8 Tab, 35 Ref.

Descriptors: *Nitrogen compounds, *Air pollution, *Streams, Ammonia, Nitrates, Organic nitrogen, West Fork Walker Branch, *Tennessee, Pollution load, Seasonal variation, *Forested watersheds, Watersheds, Water quality, Fate of pollutants, Statistical analysis, Deposition, Water pollution sources, Aeolian deposits, Wind deposits, Detritus.

The influx of atmospheric nitrogen compounds into West Fork Walker Branch, Tennessee, a relatively undisturbed 38.4 ha forested watershed, had a significant impact on the N chemistry of the stream. Six N chemistry variables (concentrations of ammonia-N, Nitrate-N, and organic N in the stream and the loading rates of each) and 27 independent variables (hydrologic, meteorological, and watershed characteristics and the N chemistry profile of wetfall, dryfall, and blow-in material) were statistically analyzed by a linear regression model. The magnitude of the atmospheric N input depended on season, vegetative cover, source of influx (wet, dry, and blow-in), and the form of N. Ammonia-N levels were more consistently related to atmospheric deposition of N compounds in all seasons. Atmospheric nitrate-N deposition was greatest in winter and summer; detrital nitrate-N flux, in spring. Nitrate leached from the soil and hydrologic factors were significant contributors to stream nitrate loads. Organic N levels were also highly dependent on seasonal characteristics. It was not possible to formulate a predictive relationship for the summer season from the statistical methods used in this study. (Cassar-FRC)
W83-01059

ORGANIC CONTAMINANTS IN GROUNDWATER NEAR AN UNDERGROUND COAL GASIFICATION SITE IN NORTHEASTERN WYOMING,
Lawrence Livermore National Lab., CA.
D. H. Stuermer, D. J. Ng, and C. J. Morris.
Environmental Science and Technology, Vol 16, No 9, p 582-587, 1982. 5 Fig, 4 Tab, 18 Ref.

Descriptors: *Groundwater pollution, *Coal gasification, *Organic compounds, *Wyoming, Groundwater, Water analysis, Water pollution sources, Gasification, Phenols, Aromatic compounds, Hydrocarbons, Amines, Monitoring, Water quality, Pollutant identification.

The composition of organic constituents observed over 15 months after the completion of gasification in groundwater samples from two aquifers near two different underground coal gasification (UCG) experiments at the Hoe Creek site in northeastern Wyoming is reported. Contaminants consisted of phenols, aromatic carboxylic acids, aromatic hydrocarbons, ketones, aldehydes, pyridines, quinolines, isoquinolines, and aromatic amines. Concentrations ranged up to about 50 ppm, with large variations both in the relative concentrations of acidic, neutral and basic constituents and in the concentrations of individual compounds. Naptha-

lene, 0-xylene, 2-methylpyridine, and 0-cresol were consistently present in high concentrations and were identified as UCG contaminant-indicator compounds that appear to be particularly useful for monitoring purposes. A simplified method of analysis for these compounds was developed. (Baker-FRC)
W83-01066

2,4,6-TRINITROTOLUENE-SURFACTANT COMPLEXES: DECOMPOSITION, MUTAGENICITY, AND SOIL LEACHING STUDIES,
Army Natick Research and Development Lab., MA.
D. L. Kaplan, and A. M. Kaplan.
Environmental Science and Technology, Vol 16, No 9, p 566-571, 1982. 4 Tab, 23 Ref.

Descriptors: *Industrial wastes, Public health, *Water pollution sources, *Leaching, Infiltration, Munitions wastes, *2,4,6-Trinitrotoluene, *Mutagenicity, *Decomposition, *Surfactants, Toluene, Organic compounds, Groundwater, Path of pollutants.

The biodegradability of TNT-surfactant complexes in soil and water was investigated and their mutagenicity assessed. The effectiveness of a proposed treatment of TNT-contaminated soils was also evaluated, involving complexing with surfactants to immobilize the TNT and prevent further leaching into the groundwater. Tests indicated that these complexes were more mutagenic than TNT alone. Soil leaching studies demonstrated that in situ immobilization of TNT in the complexed form in contaminated soils would not be feasible due to the large quantities of surfactant required and the inability of the surfactant treatment to immobilize TNT microbial reduction products. The leaching of excess surfactant and organic matter extracts into the groundwater is an additional disadvantage of the proposed treatment. Aqueous-anaerobic and soil decomposition studies showed that there are potential problems with he long-term stability of these complexes. Under these conditions in soil or water, water-soluble materials were produced non-biologically that could not be identified with TNT or any of seven known TNT reduction products. (Baker-FRC)
W83-01067

LEACHING OF CADMIUM FROM PIGMENTED PLASTICS IN A LANDFILL SITE,
Harwell Lab., Oxon (England).
D. C. Wilson, P. J. Young, B. C. Hudson, and G. Baldwin.
Environmental Science and Technology, Vol 16, No 9, p 560-566, 1982. 3 Fig, 1 Tab, 14 Ref.

Descriptors: *Waste disposal, *Cadmium, *Landfills, Plastics, Leaching, Water pollution control, Metals, Path of pollutants.

Experiments were conducted to determine whether cadmium-pigmented plastics make a significant contribution to the release of cadmium in landfill leachates. With consideration of the maximum case of 15% plastics in refuse and use of a pessimistic estimate of a peak cadmium removal of 0.5 mg/kg bed volume from the 2.5% of all plastics that contain cadmium pigment, a maximum leaching concentration of 2 micrograms/liter is suggested by the leaching tests. The low levels released suggest that the leaching observed is only from the surface of the plastic and not the bulk. Several column validation experiments were performed with pulverized domestic waste and a worst case plastic, and these demonstrated that pigmented plastics make an insignificant contribution to cadmium levels in domestic waste leachate. Thus landfill is an acceptable disposal option for cadmium-pigmented plastics. (Baker-FRC)
W83-01068

MASS BALANCE MODELING OF DDT DYNAMICS IN LAKES MICHIGAN AND SUPERIOR,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
V. J. Bierman, Jr., and W. R. Swain.
Environmental Science and Technology, Vol 16, No 9, p 572-579, 1982. 5 Fig, 6 Tab, 49 Ref.

Descriptors: *Lakes, *Pesticides, *Water pollution control, *Lake Michigan, Great Lakes, *Lake Superior, *DDT, Fate of pollutants, Agricultural chemicals, Oganic compounds, Fish, Particulates.

Data available from Lakes Michigan and Superior were used for a retrospective analysis of DDT dynamics subsequent to the imposition of the ban in 1969 on DDT use. Trends indicate that DDT levels in both lakes declined at greater rates than were expected on the basis of hydraulic detention times and the degradation rate for DDT in the environment. Under the given assumptions, settling of particulate DDT from the water column was found to be the major loss process of DDT for both lakes. Particulate settling was responsible for 61-95% of the observed DDT loss rate in Lake Michigan. Degradation and hydraulic washout were responsible for 3-35% and 2-4%, respectively. Results for Lake Superior were comparable. These ranges corresponded to results for analyses of sensitivity to variations in external DDT loads, partition coefficients, and degration half-times. Results for apparent net particulate settling velocities for DDT were consistent with analogous results for phosphorus, phytoplankton, and plutonium from independent studies. (Baker-FRC)
W83-01069

THE DEFINITION AND USE OF MIXING ZONES,
Dow Chemical Co., Midland, MI.
For primary bibliographic entry see Field 5G.
W83-01070

THE DISTRIBUTION OF LEAD, ZINC AND CADMIUM IN SEDIMENTS OF AN ORE-ENRICHED LOTIC ECOSYSTEM, THE RIVER ECCLESBOURNE, DERBYSHIRE,
Institute of Terrestrial Ecology, Huntingdon (England). Monks Wood Experimental Station.
F. Moriarty, K. R. Bull, H. M. Hanson, and P. Freestone.
Environmental Pollution, Series B, Vol 4, No 1, p 45-68, July, 1982. 7 Fig, 13 Tab, 24 Ref.

Descriptors: *Sediments, Rivers, *Metals, *Lead, *Zinc, *Cadmium, Heavy metals, Ecclesbourne River, *England, Fate of pollutants, Organic matter, Particle size.

Sediment samples were collected from 22 sites and 7 tributaries on the River Ecclesbourne in Derbyshire, England, to study lead, zinc, and cadmium derived from natural mineral veins and disused mines. Surveys were conducted in February-March 1976 and November 1977. Sediments were graded into three mesh sizes: Grade 1, 1.0 mm; Grade2, 0.5-1.0mm ; and Grade 3, 0.5 mm. Metals levels generally decreased downstream. The ratio of Cd:Zn also decreased downstream. There were pulses of sediments with relatively high metals concentrations that moved down the river. This was reflected in the significant differences in metals levels at the same site on different dates. The smallest particles tended to have the lowest Zn and Cd levels at most sites. There was little difference between the two grades of larger particles for all three metals. For Pb, differences between the three grades were not pronounced. In the upper reaches of the river Cd levels were over 100 mg per Kg, exceptionally high for rivers in England and Wales. The organic content of the sediments (2.1-3.5%) increased downstream but did not affect metals contents. (Cassar-FRC)
W83-01073

DEPOSITION AND CHEMISTRY OF POLLUTANT METALS IN LAKES AROUND THE SMELTERS AT SUDBURY, ONTARIO,
National Water Research Inst., Burlington (Ontario).
J. O. Nriagu, H. K. T. Wong, and R. D. Coker.
Environmental Science and Technology Vol 16, No 9, p 551-560, 1982. 9 Fig, 7 Tab, 68 Ref.

Descriptors: *Lakes, *Sediments, *Smelting, Water pollution sources, Heavy metals, Copper, Nickel, Zinc, Lead, Sediments, Sudbury, *Ontario, Canada, Suspended solids.

Since the smelters in Sudbury emitted about 2.6 tons of Ni, 2.6 tons of Cu, 0.7 tons of Pb, and 6.3 tons of Fe, daily during 1977 the area around Sudbury represents a unique laboratory for studying the long-term impacts of airborne pollutants on aquatic ecosystems. Organic matter constitutes 35-60% of the suspended materials in nearby lakes, but plays a minor role in the transport of metals to the sediments. Rates of metal accumulation in the sediments have been estimated typically to be 100-600, 50-300, 10-60, and 5-30 sq m/yr for Ni, Cu, Zn, and Pb, respectively. Some of the lakes with pH values of 4.5 or less show no enrichment or accumulation of pollutant metals in their surface sediments, indicating that pollutant metals previously stored in the sediments have since been leached away. This finding that the contaminated sediments can release substantial quantities of toxic metals to the overlying water must have interesting ramifications with regard to the limnological impacts of acid rains. (Baker-FRC)
W83-01078

PHOTOLYSIS OF HEXACHLOROCYCLOPENTADIENE IN WATER,
Velsicol Chemical Corp., Chicago, IL.
R. G. Butz, C. C. Yu, and Y. H. Atallah.
Ecotoxicology and Environmental Safety, Vol 6, No 4, p 347-357, August, 1982. 8 Fig, 2 Tab, 8 Ref.

Descriptors: *Degradation, *Chlorinated hydrocarbons, *Hexachlorocyclopentadiene, *Photolysis, Fate of pollutants, Organic compounds, Insecticides, Mirex, Kepone, Radiation.

Hexachlorocyclopentadiene (Hex), an intermediate in the manufacture of insecticides and chemicals, dissolved in water at a concentration of 2.2 micrograms per ml, decomposed rapidly under mercury vapor lamp irradiation. The photolytic half-life of HEX was < 1.03 min. After 10 min of irradiation 44% of the compound had been converted to water soluble products. The primary photolysis product was pentachlorocyclopentenone. Dimerization products similar to hexachloroindenone were also formed. However, no mirex or Kepone were detected in the reaction mixture. Previous suggestions that photolysis is the major process responsible for HEX degradation in such ecosystems as ponds and eutrophic lakes were thus apparently confirmed. (Cassar-FRC)
W83-01079

AN ANALYSIS OF FACTORS INFLUENCING DE-ICING SALT LEVELS IN STREAMS,
Ontario Hydro, Toronto. Dept. of Transmission Environment.
W. S. Scott.
Journal of Environmental Management, Vol 13, No 3, p 269-287, November, 1981. 9 Fig, 11 Tab, 11 Ref.

Descriptors: *Deicers, *Roads, *Streams, Fate of pollutants, *Salts, Runoff, Thawing, Drainage patterns, Urbanization, Rainfall, Black Creek, Don River, Toronto, *Ontario.

Factors affecting the input of deicing salts into streams were studied in the Black Creek and Don River, Toronto, Ontario. Salt inputs were significantly correlated with: (1) the length and type of road drainage into the stream, (2) the amount of salt applied prior to thaw periods, and (3) the road drainage pattern and topography. Salt levels and duration in the stream were affected by: (1) discharge of the receiving stream, and (2) degree of urbanization. At the point source inputs (road crossings) salt inputs were related to: (1) the rate of rise of temperature at the start of a thaw, (2) duration of temperature above freezing, (3) amount of salt applied prior to the thaw, and (4) amount of rainfall during the thaw. The most important independent variable for explaining salt input load was heat accumulated during a thaw. For a given thaw chloride concentrations and lost varied in a similar manner at points in each study area. However, the Black Creek had much higher salt concentrations

and much lower loads than the Don River. (Cassar-FRC)
W83-01088

STREAM WATER QUALITY IN A SMALL COMMERCIAL CAMPGROUND IN COLORADO,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
H. L. Gary.
Journal of Environmental Health, Vol 45, No 1, p 5-12, July/August, 1982. 6 Fig, 1 Tab, 22 Ref.

Descriptors: *Recreation, *Waste disposal, *Camp sites, Fate of pollutants, Water pollution sources, Horse Creek, *Colorado, Water quality, Streams.

The influence of a campground on stream water quality was studied during the summer of 1978 at Horse Creek, Colorado. Water samples were collected biweekly, as well as three times daily before and after the three summer holiday weekends, Memorial Day, July 4, and Labor Day. The chemical and physical qualities, including bacterial densities, were not adversely affected by recreational use of the site. This indicated that the waste disposal facilities (septic tanks) were performing satisfactorily. Suspended solids in the stream, which had little fine silt and clay, rose during periods when persons were playing in the stream but immediately dropped to normal off-season levels when there was no activity in the water. (Cassar-FRC)
W83-01090

DECOLORIZATION OF INFILTRATION WATER UNDER NATURAL CONDITIONS,
Akademiya Nauk SSSR, Moscow. Inst. Biologii Vnutrennykh Vod.
For primary bibliographic entry see Field 2F.
W83-01097

EFFECT OF MICROBIAL LIFE STAGES ON THE FATE OF METHYLMERCURY IN NATURAL WATERS,
Alberta Environmental Center, Vegreville.
S. Ramamoorthy, T. C. Cheng, and D. J. Kushner.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 2, p 167-173, August, 1982. 4 Fig, 1 Tab, 16 Ref.

Descriptors: *Mercury, *Bacteria, Sample preservation, *Fate of pollutants, *Methylmercury, Sediments, Microbiological studies, Algae, Cyanophyta, Escherichia coli, Pseudomonas fluorescens, Anabaena flos-aquae, *Ottawa River, *Ontario.

Transformations of methylmercury chloride to inorganic mercury were studied in samples of Ottawa River water, to which had been added natural sediment, living or thermally killed bacteria (Escherichia coli or Pseudomonas fluorescens), or a blue-green alga (Anabaena flos-aquae). Transformations of methylmercury in cultures of growing bacteria were also studied. Hg concentrations were set at 0.1 mg per liter to simulate severe Hg contamination. Living organisms rapidly converted methylmercury chloride to inorganic Hg. On the seventh day the percentages of inorganic Hg in various suspensions of living organisms were: P. fluorescens, 90%; E. coli, 50.6%; and A. flos-aquae, 83.4%. Water overlying the living organisms contained low levels of both forms of Hg. Experiments with thermally killed suspensions of organisms showed that most of the methylmercury and all of the inorganic Hg was bound to the dead cells within 12 hours. No transformations took place for 3 days. By the seventh day about half the inorganic Hg in the stock solution, containing 28% inorganic Hg, was transformed to methylmercury chloride, most of which was released to the water column. P. fluorescens growing in peptone-yeast extract broth media quickly converted methylmercury chloride to inorganic Hg, most of which was eventually lost as volatile Hg. No transformation of methylmercury chloride took place in E. coli cultures. Results suggest that proper storage conditions and minimum storage time is important in handling samples containing Hg. (Cassar-FRC)
W83-01104

THE SPECIATION OF IONS IN TIBER RIVER ESTUARY WATERS,
Miami Univ., FL.
F. J. Millero, G. Macchi, and M. Pettine.
Estuarine, Coastal and Shelf Science, Vol 13, No 5, p 517-534, November, 1981. 10 Fig, 10 Tab, 22 Ref.

Descriptors: *Speciation, *Estuarine environment, *Ions, Tyrrhenian sea, Chemical composition, *Italy, Chemical properties, Tiber Riber, Estuaries, Path of Pollutants.

The Tiber River basin is exploited for agricultural and industrial use, with both activities having an effect on the chemical composition of the Tiber itself. The population of the area is about 4.2 million concentrated in six urban areas, the greatest being Rome, which is located near the mouth of the river. At present raw untreated sewage is discharged from Rome. Due to the short distance between the Aniene inlet and Tiber mouth, most of these polluted waters are discharged into Tyrrhenian Sea. The composition of the major ionic constituents of the Tiber River waters was analyzed from literature data. The ratios of the major cations and anions to chloride are strongly influenced by tributary waters (Paglia, Nera and Aniene rivers). The speciations of the major cations and anions have been determined for waters formed by mixing lower Tiber river waters and Tyrrhenian sea waters of constant composition. The results are compared to similar calculations for mixing average river waters with seawater. The total or stoichiometric activity coefficients for the major ionic components have been determined from the speciation results. Values for the ionization constant of weak acids in the waters were found to be in reasonable agreement with values determined at the same absolute salinity. (Baker-FRC)
W83-01118

URANIUM, THORIUM AND LEAD NUCLIDES IN A DELAWARE SALT MARSH SEDIMENT,
Delaware Univ., Newark. Coll. of Marine Studies.
T. M. Church, C. J. III Lord, and B. L. K. Somayajulu.
Estuarine, Coastal and Shelf Science, Vol 13, No 3, p 267-275, September, 1981. 4 Fig, 3 Tab, 33 Ref.

Descriptors: *Radionuclides, *Salt marshes, *Sediments, Uranium, Thorium, Lead, *Delaware, Trace metals, Chemical analysis.

Natural isotopes of uranium, thorium, and lead have been assayed in sediments from a lower Delaware salt marsh. Uranium is concentrated in the top sections of the core and decreases with depth, from 3 to 1 d/min/g. A significant proportion of this uranium has been authigenically extracted from seawater, as is demonstrated by the observed excess ration of U234:U238(1.03-1.14). Thorium 232 is rather consistant in concentration, while the concentration of Th230 is deficient with respect to its uranium parent. In contrast to the deep sea, the fixation of authigenic reduced uranium dominates over the scavenging of Th230 in these tidal sediments. Excess Pb210 showed an exponential decay over the length of the core, and when corrected for a correspondingly significant exponential decrease in organic carbon and salt, yields a sedimentation rate of 0.47 cm/year. Although this rate approximates the local apparent rate of sea level rise, a lower limit for the rate of salt marsh accumulation, the actual rate is higher, suggesting net filling and accretion of salt marshes. The total integrated flux of Pb210 to this and other salt marsh surfaces in the eastern U.S. is calculated to more often exceed the reported local atmospheric flux. It appears that salt marshes may scavenge Pb210 as has been shown for other trace metals, from flooding waters.
W83-01123

THE DEPOSITION OF WINDSCALE RADIOCAESIUM IN THE WYRE ESTUARY AND THE MEASUREMENT OF SEDIMENTATION RATES,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
S. R. Aston, and J. E. Rae.
Marine Environmental Research, Vol. 7, No. 2, p 83-90, 1982. 1 Fig, 2 Tab, 21 Ref.

Descriptors: *Estuaries, *Water pollution sources, *Sediments, *Radiocesium, Cesium, Isotopes, Radioisotopes, *Sedimentation rates, Windscale Nuclear Facility, Nuclear fuels, *England.

Sediment profiles from the Wyre estuary, Northwest England, have been analyzed for their Cs-137 and Cs-134 activities and the percent less than 63 microm grain size fractions. The results indicate that sediments are contaminated with radiocesium isotopes derived from the Windscale nuclear fuel reprocessing facility about 60 km north of the Wyre estuary. The activities of the radiocesium in different core segments are correlated with the percent less than 63 microm grain size fraction variations in the sediment profiles, but the ratios of Cs-134 to Cs-137 isotopic patterns in the cores and in the Windscale annual discharges have allowed estimates of the net sedimentation rates to be calculated. The range of values obtained was 2 to 3.6 cm/year. However, these results are probably subject to errors of about 10% based on experimental errors alone. (Baker-FRC)
W83-01138

AVON-HEATHCOTE, ESTUARY UNDER STRESS,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
R. Stephenson.
Soil and Water, Vol. 16, No. 2, p 22-25, April, 1980. 4 Fig.

Descriptors: *Estuaries, *Water resources development, *Water pollution effects, *Water pollution sources, Nutrients, Nitrogen, Phosphorus, Water quality, Industrial wastes, Decomposing organic matter, *New Zealand, Avon-Heathcote Estuary.

The Avon-Heathcote Estuary has reflected the drastic alteration of its drainage basin by changes in its own physical, chemical and biological characteristics. Changes in vegetation, drainage patterns and land cover altered the nature and degree of flow characteristics and sedimentation. Domestic and industrial effluents discharged into the rivers and into the estuary proper have had far-reaching effects on the kinds and number of plants and animals within the estuary. Effluent discharge into the estuary has two components - toxic chemicals and organic matter. Toxic industrial pollutants mainly enter via the Heathcote River and include arsenic and chromium compounds from tanneries; hydrochloric acid from glue factories; acids, alkalies and sulfur compounds from woolen mills; bisulfate of lime from wool scours; acids, copper and lead from metalworks; and tars and oils from gas works. Some of the changes which have occurred at this estuary are reversible, and the estuary itself still appears to be carrying out its primary role. (Baker-FRC)
W83-01149

ANIONIC SURFACTANT CONCENTRATION IN THE RIVER AND SEA WATERS OF HYOGO PREF. AND ITS RELATIONSHIP TO PHOSPHORUS CONCENTRATION, (IN JAPANESE),
Hyogo Prefecture Environmental Science Inst., Kobe (Japan).
Y. Kobuke.
Japanese Journal of Limnology, Vol 42, No 4, p 189-200, October, 1981. 7 Fig, 5 Tab, 35 Ref. (English Summary).

Descriptors: *Surfactants, *Water pollution sources, *Detergents, Hyogo Prefecture, *Japan, Rivers, Seawater, Phytoplankton, Water pollution control, *Phosphorus, Pollutant identification.

The distribution of anionic surfactants determined as methylene blue active substances (MBAS) in the river and sea waters of Hyogo Prefecture was investigated. The method was corrected for the interference of photosynthetic pigments of phytoplankton. MBAS concentration in thee river waters was higher in the coastal areas of Osaka Bay and Harima Nada, where population and in-

dustry were centralized. Concentrations greater than 1 mg/liter were observed, especially in smaller rivers. In the sea waters of Osaka Bay and Harima Nada, the highest concentration of MBAS was found near the northern coasts where a high concentration of MBAS was noted in river waters. The findings suggest that anionic surfactant pollution of the river and sea waters was due largely to domestic and industrial effluents. The annual loadings of anionic surfactant as MBAS were estimated by statistical data to be about 11,000 tons per year, 37% from industry and the rest from domestic waste. Due to the good correlation between MBAS and various forms of phosphorus it was presumed that detergents including condensed phosphates as a builder may cause an increase in phosphorus concentration in the river water. (Baker-FRC)
W83-01152

DISTRIBUTIONS OF HEAVY METALS IN BOTTOM MUD AND POLYGONUM NODOSUM IN THE WATARASE RIVER (IN JAPANESE),
Takasaki Coll. of Economics, Gumma (Japan).
F. Tada, Y. Wada, and S. Suzuki.
Japanese Journal of Limnology, Vol 43, No 1, p 44-47, January, 1982. 3 Fig, 7 Ref. English summary.

Descriptors: *Bottom sediments, *Heavy metals, Algae, Lead, Copper, Cadmium, Zinc, Mud, Rivers, Water pollution effects, Industrial wastes, Polygonum nodosum, Watarase River, *Japan, *Path of pollutants.

The distribution of copper, zinc, lead, and cadmium was investigated in both samples of bottom mud and samples of Polygonum nodosum obtained from the Watarase River. This river is heavily polluted with drainage from refineries. Mud samples collected from upstream near the pollution source and the downstream alluvial fan were highly polluted with metals. These results indicate that the metal concentration of mud was related to the slope of the river bed. The amount of heavy metals in P. nodosum had a relationship with 0.1M EDTA extractable metals in the mud. P. nodosum collected from upstream showed high metal contents. Judging from these results it was suggested that the chemical form of metals in the mud may differ from upstream to downstream. (Baker-FRC)
W83-01175

WATER-TABLE MAP OF THE SAN JOSE WELL FIELD AND VICINITY, ALBUQUERQUE, NEW MEXICO, SPRING 1981,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-01184

TIME OF TRAVEL OF SOLUTES IN THE VERMILION RIVER, LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
A. J. Calandro.
OFSS, USGS. Box 25425, Fed. Ctr. Denver, CO 80225. Paper copy $2.50, Microfiche $3.50. Geological Survey Open-File Report 81-1065, 1981. 19 p, 13 Fig, 3 Tab, 5 Ref.

Descriptors: Streamflow, *Dye releases, *Tracers, *Path of pollutants, Flow rates, Streams, Tracking techniques, Solutes, *Louisiana, Vermilion River, Time of travel.

Dye-tracer studies were made in November 1978 and in June 1979 to define streamflow patterns in the Vermilion River. For the November 1978 study the tracer was injected at two locations, Surrey Street in Lafayette and about 7 miles downstream at State Highway 3073; the discharge at Surrey Street at the time of injection was 218 cubic feet per second. The two dye clouds merged at Broussard Cemetery, about 12.2 miles downstream from Surrey Street, after an elapsed time of about 270 hours. After 438 hours the dye cloud extended form the Abbeville bridge (Louisiana Highway 14 Bypass) upstream about 14.5 miles. In June 1979, a tracer was injected into the river at Surrey Street at Lafayette; the discharge at Surrey Street at the time of injection was 161 cubic feet per second. Forty-two hours after injection the leading edge of the tracer was located at the Milton pumping plant, 14 miles downstream from the injection site. The average pumping rate of the plant during the study was 440 cubic feet per second. Ninety hours after injection, no indication of the tracer was found in the river, but the tracer was found in a rice-irrigation cannal at State Highway 14, about 10 miles west of Abbeville. (USGS)
W83-01189

STREAMFLOW AND WATER-QUALITY CONDITIONS, WILSONS CREEK AND JAMES RIVER, SPRINGFIELD AREA, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
For primary bibliographic entry see Field 4C.
W83-01192

ADSORPTION AND DESORPTION OF HEAVY METALS IN BOTTOM MUD OF URBAN RIVERS,
Takasaki Coll. of Economics, Gumma (Japan). Chemical Lab.
F. Tada, and S. Suzuki.
Water Research, Vol 16, No 10, p 1489-1494, October, 1982. 1 Fig, 11 Tab, 18 Ref.

Descriptors: *Rivers, *Bottom sediments, *Heavy metals, Copper, Zinc, Cadmium, Lead, Mud, Urban areas, Adsorption, Organic compounds, Fate of pollutants, *Japan, Yahagi River, Tsuoumi River.

The main factors influencing the adsorption of Zn, Cu, Cd, and Pb in urban rivers were investigated. The chemical forms of the adsorbed metals were identified. Adsorption of Cu, Zn, Cd, and Pb was described using the Freundlich adsorption equation. The Freundlich constant was related to the grain size and organic matter content of bottom mud. It was found that the main factor controlling the adsorption of metal was organic matter, since the adsorbed metals decreased remarkably due to the destruction of organic matter from the fine bottom mud. The desorption experiment proved that the metals adsorbed by mud were extracted about 100% with dilute hydrochloric acid. Therefore, the amount of heavy metal adsorbed per g of total organic carbon can be calculated from the acid soluble metal content of bottom mud. Moreover, the method of extraction by 2N CH3C00NH4 can be used to distinguish between an ion exchangeable form adsorbed by minerals and a chemical form adsorbed by organic matter.The Adsorption and desorption experiments indicated that fine bottom mud with a high organic matter content contributed to the uptake of metals in urban rivers and that such metals can be extracted with 0.5 N HC1. (Baker-FRC)
W83-01194

MICROBIAL CONTAMINATION OF CONTINENTAL SHELF SEDIMENTS BY WASTEWATER SLUDGE,
Environmental Protection Agency, Annapolis, MD.
M. L. O'Malley, D. W. Lear, W. N. Adams, J. Gaines, and T. K. Sawyer.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1311-1317, September, 1982. 3 Fig, 4 Tab, 21 Ref.

Descriptors: *Sludge disposal, *Bacteria, *Marine sediments, Fate of pollutants, Ocean dumping, *Middle Atlantic Bight, Disposal, Microorganisms, Amoebae, Parasites, Pathogens, Sediments, Coliforms, Streptococci, Indicators, Delaware Bay.

Surface sediment samples from the region around on ocean wastewater sludge disposal site in the Middle Atlantic Bight, 71 km southwest of the mouth of Delaware Bay, contained significant levels of coliforms (TC), fecal coliforms (FC), fecal streptococci (FS), and Acanthamoeba. Sampling was conducted on 6 cruises from April 1978 to August 1980. The highest percentage of positive stations (38% of stations positive for TC and 25% for FC) was located within 9 km of the disposal site center. The percentage of positive stations decreased with increasing distance from the center of the dumpsite. Positive samples were found as far as 37 km from the center. Sludge tended to travel in northeast and southwest directions and to settle in low spots. An area of at least 1190 sq km of ocean bottom was affected by the sludge dumping. The percentage of positive stations decreased with time. TC, FS, and amoebae were more persistent in sediments than FC. Therefore, FC can be considered an indicator of recent sludge deposition. (Cassar-FRC)
W83-01214

ACID DEPOSITION,
For primary bibliographic entry see Field 5C.
W83-01217

POTENTIAL EUTROPHICATION OF THE RIDEAU RIVER BY AN URBAN WATERWAY: DISCUSSION,
Gore and Storrie Ltd., Toronto (Ontario).
For primary bibliographic entry see Field 5C.
W83-01219

THE ESTABLISHMENT OF WATER QUALITY GRADIENTS IN RESERVOIRS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
R. H. Kennedy, K. W. Thornton, and R. C. Gunkel, Jr.
Canadian Water Resources Journal, Vol 7, No 1, p 71-87, 1982. 6 Fig, 16 Ref.

Descriptors: *Water quality, *Reservoirs, Physical properties, Chemical properties, Lake morphology, Hydrodynamics, Sedimentation, Hydrology, Tributaries, Mixing, West Point Lake, *Georgia, Phosphorus, Chlorophyll, Suspended solids, Turbidity.

Results are presented of three intensive water quality surveys conducted at West Point Lake, Georgia, during 1979. The findings document the existence of marked longitudinal gradients in the concentrations of total phosphorus, chlorophyll a and suspended solids (turbidity) from headwater to dam in this large reservoir. Comparisons of data from cove and main-pool stations also indicated the presence of significant lateral heterogeneities. The occurrence of such gradients must be noted in the design, implementation and interpretation of sampling programs if effective management strategies are to be developed for ameliorating reservoir water quality problems. Marked physical, chemical, and biological gradients were noted in West Point Lake related to lake morphology, hydrodynamics, sedimentation, hydrology and inflow water quality. Of these, tributary size and location as well as channel slope and reservoir length to width relationships appear to be principal factors. Within limits established by these factors, sedimentation and mixing processes further dictate the fate of influent nutrients and material and their impact on biological communities. (Baker-FRC)
W83-01222

MATHEMATICAL MODEL FOR DISSOLVED OXYGEN IN THREE SOUTHERN ONTARIO RESERVOIRS,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
W. J. Snodgrass.
Canadian Water Resources Journal, Vol 7, No 1, p 397-415, 1982. 4 Fig, 1 Tab, 24 Ref.

Descriptors: *Mathematical models, *Dissolved oxygen, *Reservoirs, *Ontario, Canada, Model studies, Mathematical equations, Oxygen, Water analysis, Stratification, Vertical transport, Temperature effects, Wind.

The rate of hypolimnetic oxygen depletion in reservoirs of the Grand River system (Southern Ontario) has been analyzed with the objective of developing mathematical models capable of predicting oxygen regimes and of being used by water

quality managers. The oxygen regimes of these reservoirs are dominated mainly by watershed inputs and internal biochemical processes. In this work, it is hypothesized that oxygen decay is controlled by land-base inputs of phosphorus and that decay may be modeled using the phosphorus cycle in each reservoir. A temperature model was selected to make predictions of vertical transport and showed good agreement with observations during most of the year in cases where wind data was available from near each reservoir, but poor agreement when data from some distance was used. It predicts extensive mixing near the end of summer stratification. These problems result from atmospheric boundary effects caused by the lee effects afforded by surrounding hills. A phosphorus-oxygen model was modified for application. Oxygen decay was estimated by the decay of particulate phosphorus. It was concluded that a reasonable calibration was obtained, but that a reasonable verification was not obtained due to inadequate predictions of vertical mixing, particularly near the end of stratification. (Baker-FRC)
W83-01227

FATE OF POLYCHLORINATED BIPHENYLS (PCBS) IN SOIL PLANT SYSTEMS,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
D. Pal, J. B. Weber, and M. R. Overcash.
Residue Reviews, Vol. 74, 1980, p. 45-98. Springer-Verlag New York. OWRT B-122-NC (8), 14-34-0001-9088.

Descriptors: *Polychlorinated biphenyls, Land-Application Plant uptake, *Decomposition, *Soil adsorption, Toxicity, Aromatic hydrocarbons, Water pollution effects, *Fate of pollutants, *Food chain, *Aroclors, *Soil-Plant Systems.

Polychlorinated biphenyls are a family of snythetic chlorinated aromatic organics that are thermally, chemically, and electrically very stable. Only recently these substances have been traced as contaminates far from the centers of production and use. Toxicity, metabolic fate, and environmental chemistry of PCBs are the topics of much current study. Individual PCB species and isomers vary widely in their susceptibility to biodegradation. All isomers of mono- and di-chlorobiphenyls are degraded by a number of aerobic soil microorganisms. Many isomers of tri -, and tetra-chlorinated species are also degraded but a few are more resistant to biodegradation and metabolism. Only a few isomers of penta- and hexa-chlorobiphenyls are known to biodegrade and most of the isomers are very persistent. With increasing solubility in water, even the most persistent ones biodecompose at finite rates. Many isomers of tri-, tetra-, and penta-, and hexa-chlorobiphenyls have not been studied and virtually nothing is known about the fate of hepta-, octa-, and nona-chlorobiphenyls in the soil-plant environment. Because of the toxicity and accumulative nature of highly chlorinated PCBs, the soil assimilative capacity design for land treatment must be considered on very conservative terms. PCBs do decompose in a soil system, probably more rapidly than in any other waste management alternative or receiver system involving biological activity. Research is needed to establish the terrestrial rates of decomposition of all species and isomers that are present in Aroclors, and to find the soil levels above which the application of different PCB consistents adversely affects the food chain.
W83-01235

SEEPAGE PONDS TO RECYCLE MUNICIPAL WASTEWATER,
South Dakota State Univ., Brookings. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W83-01238

EFFECTS OF A HEXACHLOROBIPHENYL AND PENTACHLOROPHENOL ON GROWTH AND PHOTOSYNTHESIS OF PHYTOPLANKTON,
New York State Dept. of Health, Albany. Environmental Health Center.
For primary bibliographic entry see Field 5C.
W83-01242

OVERVIEW OF PHYTOPLANKTON CONTAMINANT PROBLEMS,
New York State Dept. of Health, Albany. Environmental Health Center.
G-Y. Rhee.
Journal of Great Lakes Research, Vol. 8, No. 2, p 326-327, 1982. 13 Ref.

Descriptors: *Air-water interfaces, *Phytoplankton, *Accumulation, Fate of pollutants, Surface films, Films, Water pollution effects, *Chlorinated hydrocarbons, Adsorption, Bioaccumulation, Organic compounds, *Polychlorinated biphenyls.

The surface film communities of planktonic algae (phytoneuston) are exposed to pollutant concentrations higher than in the subsurface water. Adsorption of organochlorine compounds is much faster than desorption, indicating that contaminated cells, after a return to more dilute subsurface waters, may not desorb the pollutants rapidly or completely. The bioaccumulation factor or partition coefficient increases with decreasing biomass per unit volume. Certain low levels of organochlorine pollutants stimulate photosynthesis in phytoplankton. This mechanism has a destabilizing effect on the ecology and may have potential significance in human toxicology. (Cassar-FRC)
W83-01243

MICROBIOTA IN SURFACE FILMS: AN HISTORICAL PERSPECTIVE,
New York State Dept. of Health, Albany. Environmental Health Center.
G. W. Fuhs.
Journal of Great Lakes Research, Vol. 8, No. 2, p 312-315, 1982. 29 Ref.

Descriptors: *Bacteria, *Air-water interfaces, *Degradation, Reviews, *Microbiological studies, Fate of pollutants, Biodegradation, Organic matter, *Surface films, Films, History.

Microbiota at the air-water interface have been the subject of research for 50 years. The ubiquitous organic surface film and the significant enrichment of bacteria produce sampling errors in microbiological studies. The microbiota contribute to organic content of the microlayer as a result of their metabolism, actively degrade organic pollutants, and produce oil-dispersing surfactants. The environment of the film approaches that of a culture media. The bacteria-rich layer is an important consideration in swimming pools and in stagnant areas near docks. (Cassar-FRC)
W83-01245

OVERVIEW OF ATMOSPHERIC INPUTS AND LOSSES FROM FILMS,
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
S. J. Eisenreich.
Journal of Great Lakes Research, Vol. 8, No. 2, p 241-242, 1982. 9 Ref.

Descriptors: *Air-water interfaces, *Aerosols, *Enrichment, Fate of pollutants, *Surface films, Lakes, Particulate matter, Chlorinated hydrocarbons, Organic compounds, Polychlorinated biphenyls, Metals, Deposition, Air pollution, Films.

A surface film on water bodies contains particulate matter with greater concentrations of metal and organic matter than the subsurface water. The film thickness may vary from 0.002 microns (monomolecular layer) to 0.02 microns, with 30 microns (stagnant diffusion film) as an extreme case. Typical particulate diameters are 0.1-4 microns. Enrichment factors in the surface film are 1000-10,000. In heavily polluted environments 20-90% of the metal burden in the surface film is derived from particle deposition; in pristine waters, from in-lake processes. Airborne particles and aerosols contribute significantly to pollution in surface films and are readily available for reaction with the biotic community. (Cassar-FRC)
W83-01246

BACTERIONUESTON INVOLVED IN THE OXIDATION OF HYDROCARBONS AT THE AIR-WATER INTERFACE,
Calgary Univ., (Alberta). Dept. of Biology.
R. C. Wyndham, and J. W. Costerton.
Journal of Great Lakes Research, Vol 8, No 2, p 316-322, 1982. 8 Fig, 1 Tab, 22 Ref.

Descriptors: *Air-water interfaces, *Bacteria, *Hydrocarbons, Fate of pollutants, Degradation, Biodegradation, Microbial degradation, Oil slicks, Bitumen, Microbiological studies, *Neuston, Surface films, Polymers, Polysaccharides, Films.

Neuston microorganisms in a community of bituminous hydrocarbon degraders were observed using the techniques of critical point drying and thin sectioning with transmission electron microscopy. The mixed bacterial population was isolated from sediments of the Steepbank River, Alberta, in the oil sands region. Bacteria formed a continuous layer, 5-15 microns thick, of polymeric polysaccharide mat within 3-6 weeks of growth. The most rapid growth occurred in areas of thinnest oil cover. The process of biodegradation may involve an initial hydrophobic exclusion of cells at the interface followed by a stronger adhesion consolidated by the extracellular polymer produced. Cell fragments and other organic particulate matter accumulated at the air-water interface. In an undisturbed mixed population culture growing on Athabasca bitumen surface film for 120 days at 22 C the saturate, aromatic, and first polar fractions were strongly degraded, leaving a residue of polar fractions 2 and 3 and asphaltene. Total recovery of bitumen was 40%. (Cassar-FRC)
W83-01247

TRACE METAL ACCUMULATION IN SURFACE MICROLAYERS,
Wisconsin Univ., Madison, Dept. of Civil and Environmental Engineering.
D. E. Armstrong, and A. W. Elzerman.
Journal of Great Lakes Research, Vol 8, No 2, p 282-287, 1982. 6 Tab, 16 Ref.

Descriptors: *Metals, *Enrichment, *Air-water interfaces, Reviews, *Trace metals, Surface films, Fate of pollutants, Fallout, Heavy Metals, Aerosols, Residence time, Particulate matter, Films.

Factors controlling trace metal accumulation in surface microlayers of water bodies include properties and composition of the microlayer, form of the trace metal, source of the trace metal, processes controlling metal transport to and through the microlayer, longevity of the microlayer, and residence time of metal in the microlayer. The presence of slicks and surface matter greatly increases enrichment of metals. The particulate phase is richer in metals than the dissolved phase. Trace metals may enter the surface film from atmospheric fallout or from the underlying water. Residence times of metals in the microlayer vary from a few seconds under wind conditions of 5-10 m per sec (particulate Fe) to 0.6 hours for particulate Pb under calm conditions. (Cassar-FRC)
W83-01248

ATMOSPHERIC ROLE IN TRACE METAL EXCHANGE AT THE AIR-WATER INTERFACE,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
S. J. Eisenreich.
Journal of Great Lakes Research, Vol 8, No 2, p 243-256, 1982. 2 Fig, 13 Tab, 65 Ref.

Descriptors: *Air-water interfaces, *Metals, *Enrichment, Fate of pollutants, Surface films, *Lake Superior, *Lake Michigan, Lakes, *Trace metals, Heavy metals, Fallout, Aerosols, Residence time, Bubbles, Films.

Trace metals levels in Lake Superior surface films were higher than in subsurface water. Sources of these metals were atmospheric fallout and in-lake bubble scavenging processes. In Lake Superior most of the Fe, Mn, Ca, Pb, Cr, Zn, Cd, and Ni in the surface film was derived from in-lake processes. Previous work on Lake Michigan films indicated significant metals contributions from atmos-

pheric fallout. Enrichment factors (surface film/subsurface water) for total metals were 2-10; for particulate metals, 0-36. Lake aerosols were enriched in Cu, Pb, Zn, and Cd as a result of bubble bursting at the air-water interface. Residence times of the metals in the surface film were 16-83 min for Fe, Al, Mn, Pb, Cr, Zn, and Cd and near zero for Ca and Mg. (Cassar-FRC)
W83-01255

PESTICIDE PARTITIONING IN ARTIFICIAL SURFACE FILMS,
Canada Center for Inland Waters, Burlington (Ontario).
R. F. Platford.
Journal of Great Lakes Research, Vol 8, No 2, p 307-309, 1982. 1 Fig, 1 Tab, 15 Ref.

Descriptors: *Pesticides, *Enrichment, *Solubility, *Air-water interfaces, Chlorinated hydrocarbons, Polychlorinated biphenyls, *Surface films, *Partition coefficients, Organic matter, Films.

Octanol partition coefficients for 4,4'-dichlorophenyl and for 2,3,4,5-tetrachlorobiphenyl were 10-1000 times higher when octanol was in the form of a film on a water surface than in bulk form. This agreed with results from previous studies on lindane, DDT, and hexachlorobenzene. The logs of the partition coefficients were: 4,4'-dichlorobiphenyl (concentration 0.3-5 ppb), 5.2 bulk and 6.7-7.7 surface; and 2,3,4,5-tetrachlorobiphenyl (concentration 0.05-0.5 ppb), 5.9 bulk and 7-9 surface. Results show that surface slicks on natural waters can accumulate much higher concentrations of chlorinated compounds than the bulk partition coefficients indicate. (Cassar-FRC)
W83-01256

OVERVIEW OF CONTAMINANT INTERACTIONS WITH SURFACE FILMS, ZOOPLANKTON, AND FISH,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behaviroal Biology.
D. C. McNaught.
Journal of Great Lakes Research, Vol 8, No 2, p 358-359, 1982. 6 Ref.

Descriptors: *Air-water interfaces, *Enrichment, *Zooplankton, Fate of pollutants, Fish, Surface films, Films, Lipids, Food chains, Phytoplankton, Organic matter.

The surfaces of the Great Lakes and other water bodies are covered with a film of lipid-rich organic matter in which zooplankton and fish are exposed to contaminants during excursions to the surface. Work to define the mechanisms and effects of this region of concentration pollutants produced mixed results. Some investigators found that equilibrium partioning was an important mechanism regulating pollutant concentrations in lipids of small organisms; concentration was less important than lipid content. The hypothesis that zooplankton feeding on organic surface films could receive 10 times more contaminants than similar populations in subsurface waters is difficult to verify. Other workers concluded that partitioning accounted for very little of the contaminants reaching the top predator, in contrast to conclusions about smaller organisms. Concentrations of pollutants were 1000 times higher in phytoplankton than in water and 1 million times higher in zooplankton than in water. (Cassar-FRC)
W83-01257

CALCULATED CONTRIBUTION OF SURFACE MICROLAYER PCB TO CONTAMINATION OF LAKE MICHIGAN LAKE TROUT,
Manhattan Coll., Bronx, NY. Dept. of Environmental Engineering and Science.
J. P. Connolly, and R. V. Thomann.
Journal of Great Lakes Research, Vol 8, No 2, p 367-375, 1982. 5 Fig, 2 Tab, 14 Ref.

Descriptors: *Air-water interfaces, *Enrichment, *Chlorinated hydrocarbons, Fate of pollutants, Trout, *Lake Michigan, Lakes, Surface films, Alewife, Films, Polychlorinated biphenyls, Flood chains, Model studies, Zooplankton, Phytoplankton.

Results of a food chain model indicated that a maximum of 12% (3 micrograms per g) of the PCB concentration in adult lake trout could be derived from the surface microlayer of Lake Michigan. The model was calibrated to the Lake Michigan pelagic food chain structure. Zooplankton were assumed to spend part of the day feeding in the surface film, which contained 2.1 times higher PCB levels than the subsurface water. Average PCB concentrations in each level of the food chain, with zooplankton exposure to the microlayer, were: phytoplankton, zooplankton, and mysis, < 1 microgram per g wet weight; alewife, 4.2 micrograms per g; and trout, 14.5 micrograms per g. Critical parameters in the model are the enrichment factor in the microlayer (greatest in windrows) and the percentage of time spent by zooplankton in the microlayer. (Cassar-FRC)
W83-01258

ENRICHMENT OF PCBS IN LAKE MICHIGAN SURFACE FILMS,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
C. P. Rice, B. J. Eadie, and K. M. Erstfeld.
Journal of Great Lakes Research, Vol 8, No 2, p 265-270, 1982. 1 Fig, 2 Tab, 22 Ref.

Descriptors: *Polychlorinated biphenyls, *Air-water interfaces, *Enrichment, Chlorinated hydrocarbons, Surface films, Films, *Lake Michigan, Lakes, Aroclors, Fate of pollutants, Organic compounds, Particulate matter.

Polychlorinated biphenyl (PCB) distribution in Lake Michigan surface film and underlying water was determined from analysis of samples collected during three cruises in 1979-1980. The PCB concentrations (ng per kg) were: air, 2.8 (average); surface microlayer, 3.30-50.13; and subsurface water, 1.11-11.18. The percentages of Aroclor 1254 in the total PCB mixture (Aroclor 1254 plus Aroclor 1242) were: air, 30.3%; surface microlayer, 54.4-58.0%; and subsurface water, 62.0-65.9%. Aroclor 1254's preferential adsorption was related to its higher partition coefficient and higher degree of chlorination. Of the total PCB (particulate and dissolved), particulate PCB comprised 30.0-66% in the microlayer, 17.4-23.6% in the subsurface water, and < 5% in the air. (Cassar-FRC)
W83-01259

MODELING TRACE METALS IN THE SURFACE MICROLAYER,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
A. W. Elzerman.
Journal of Great Lakes Research, Vol 8, No 2, p 257-264, 1982. 4 Fig, 31 Ref.

Descriptors: *Air-water interfaces, *Enrichment, *Metals, *Model studies, Trace metals, Surface films, Films, Fate of pollutants, Kinetics, Aerosols, Residence time, Reviews, Isotope studies, Mixing.

This paper reviews some of the modeling approaches for investigating trace metal enrichment in surface microlayers. These techniques concern sources, sinks, and concentration controlling mechanisms. Two approaches have been used to quantitate fluxes to and from the surface film: (1) estimation of previous fluxes from measurements of trace metals entering or leaving the film and (2) measurement or modeling of fluxes at the boundaries of the film. These approaches use calculation of enrichments, element ratios and correlations, tracer elements, chemical element balances, and factor analyses. The equilibium concentration in the surface microlayer may be studied with models of competitive complexation and by a computer-based equilibrium speciation model (REDEQL). Studies on kinetics of interactions in the surface microlayer have been undertaken only recently. They concentrate on particle residence time and reactivity. (Cassar-FRC)
W83-01260

SHORT CYCLING OF CONTAMINANTS BY ZOOPLANKTON AND THEIR IMPACT ON GREAT LAKES ECOSYSTEMS,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
D. C. McNaught.
Journal of Great Lakes Research, Vol 8, No 2, p 360-366, 1982. 4 Tab, 24 Ref.

Descriptors: *Zooplankton, *Polychlorinated biphenyls, *Air-water interfaces, Fate of pollutants, Short cycling, Cycling, Surface films, *Organic matter, Detritus, Sublethal effects, Chlorinated hydrocarbons, Predation, Phytoplankton, Fish, Accumulation, Bioaccumulation, Food habits, Films, Great Lakes.

There is clear laboratory evidence of short cycling of organic contaminants at the air-water interface directly into zooplankton and fish. In short cycling bioconcentration in phytoplankton is not involved. However, field data are relatively scarce. The common mechanisms for incorporating the surface contaminants into the higher life forms are ingestion of organic matter platelets and detritus. Zooplankton vary in their susceptibility to accumulation of surface contaminants depending on time spent in the surface layer, choice of food organisms or resuspending detritus, and daily patterns of feeding. Omnivore zooplankton consuming phytoplankton and polychlorinated biphenly (PCB)-containing detritus took up 144 micrograms per g; when fed phytoplankton alone, only 60 micrograms per g. However, Chydorus and Diaptomus, selecting large cells rather than detritus, accumulated 32 micrograms PCB per g in the presence of large cells alone and 18 micrograms per g in an environment of large cells plus detritus. Low levels (25 micrograms per liter) of PCB reduced grazing activity in zooplankton as much as 43%. PCB also affects population growth by decreasing egg production and increasing death rates. (Cassar-FRC)
W83-01263

REVERSIBLE AND RESISTANT COMPONENTS OF PCB ADSORPTION-DESORPTION: ADSORBENT CONCENTRATION EFFECTS,
Manhattan Coll., Bronx, NY. Environmental Engineering and Science Program.
D. M. Di Toro, L. M. Horzempa, M. M. Casey, and W. Richardson.
Journal of Great Lakes Research, Vol 8, No 2, p 336-349, 1982. 10 Fig, 3 Tab, 11 Ref.

Descriptors: *Polychlorinated biphenyls, *Adsorption, *Sediments, Fate of pollutants, Chlorinated hydrocarbons, Hexachlorobiphenyl, Partition coefficient, *Saginaw Bay, Particulate matter, Suspended sediments, Model studies, Desorption, *Lake Huron.

The partition coefficient of ploychlorinated biphenyls (PCB), as 2,4,5,2',4',5'-hexachlorobiphenyl, decreased with increasing concentrations of adsorbent (Saginaw Bay sediment). Adsorption and desorption were not completely reversible. This effect was analyzed with an adsorption-desorption model with resistant and reversible components. The resistant component showed essentially constant partitioning; the reversible component partition coefficient was inversely related to the adsorbent concentration. Data from adsorption-desorption experiments corresponded to model results. Adsorption-desorption behavior varied among different types of sediments used. The resistant component partition coefficient varied strongly, whereas the reversible component varied weakly. (Cassar-FRC)
W83-01264

OVERVIEW OF MICROBIOTA IN SURFACE FILMS,
New York State Dept. of Health, Albany.
G. W. Fuhs.
Journal of Great Lakes Research, Vol 8, No 2, p 310-311, 1982. 5 Ref.

Descriptors: *Air-water interfaces, *Bacteria, *Enrichment, Fate of pollutants, Surface films, Degradation, Beidegradation, Lakes, Organic matter, Organic compounds, Films, Great Lakes.

Surface microlayers on water bodies are universally colonized by bacteria and other microorganisms.

Initial anchoring is due to the organism's interaction with the film-forming chemicals. Additional immobilization is a result of a fibrous polysaccharide exopolymer excreted by the bacteria. The sticky substance also effectively adsorbs chemicals and complexes metals. Bacterial numbers are enriched 8-24 times in the surface film compared with subsurface water. The more eutrophic waters have more pronounced surface slicks. Surface films continually concentrate organic matter and other contaminants, which are bacterially degraded faster in the film than if the pollutants had remained dispersed through the water column. (Cassar-FRC)
W83-01265

FRACTIONATION OF HYDROPHOBIC ORIGIN MATERIALS IN SURFACE MICROLAYERS,
Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
P. A. Meyers, and O. E. Kawka.
Journal of Great Lakes Research, Vol 8, No 2, p 288-298, 1982. 3 Fig, 3 Tab, 49 Ref.

Descriptors: *Air-water interfaces, *Organic compounds, *Solubility, Films, Surface films, Fatty acids, *Lake Michigan, Lakes, Particulate matter, Alkanes, Hydrocarbons, Fate of pollutants, Great Lakes.

Organic microlayers on the surface of Lake Michigan were sampled during 1977 at 10 open lake stations located along the north-south transect and at river mouth and nearshore stations. Surface film concentrations of organic matter and fatty acids were higher in dissolved and particulate phases than subsurface waters. The subsurface concentrations remain constant down to a depth of 5 m. In the lake stations dissolved organic carbon concentrations were 5 times greater than those of particulate organic carbon. There was considerable interstation variability in concentrations of organic materials. Formation of the surface film was dependent on aquatic biological processes rather than on river input. Hydrocarbons in the microlayer and subsurface water included long chain compounds (terrigenous origin), short chain compounds (algal origin), and pristane, phytane, and squalene (aquatic origin). The large solubility differences among the different organic compounds did not influence surface/subsurface fractionation as much as input and removal processes. (Cassar-FRC)
W83-01266

MODELS OF PARTICLE DRY DEPOSITION TO A LAKE SURFACE AND SOME EFFECTS OF SURFACE MICROLAYERS,
Illinois Univ. at the Medical Center, Chicago. School of Public Health.
J. A. Schmidt.
Journal of Great Lakes Research, Vol 8, No 2, p 271-280, 1982. 6 Fig, 2 Tab, 33 Ref.

Descriptors: *Air-water interfaces, *Deposition, *Mass transfer, Surface films, Films, Lakes, Aerosols, Bubbles, Great Lakes, *Lake Michigan, *Model studies, Particulate matter, Roughness coefficient, Particle size, Organic matter, Metals, Fate of Pollutants, Waves, Diffusion coefficent, Wind velocity.

An evaluation of empirical and theoretical models of dry deposition shows that uncertainty exists in calculating fluxes for particles and their chemical components. Mechanisms responsible for particle transport between air and water are gravitational settling, eddy diffusion, and Brownian diffusion. These processes are dependent on particle size and density, particle height, wind speed, atmospheric stability, and surface roughness. Although surface microlayers can decrease roughness, they have signifacant cotrol over deposition rates only at a very low level. Bursting bubbles may be an important factor in determining net atmospheric loading rates because metals and organic contaminants are enriched in the surface film. (Cassar-FRC)
W83-01267

WATER QUALITY CONSIDERATIONS IN THE SLURRY PIPELINING OF COAL,
Arkansas Univ., Fayetteville. Dept. of Civil Engineering.
J. W. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139923, Price codes: A09 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center Publication No 84, August 1981. 185 p, 129 Fig, 8 Tab, 32 Ref. OWRT B-059-ARK(1). 14-34-0001-6058.

Descriptors: *Coal, *Coal slurry pipelines, *Wastewaters, *Water pollution, *Industrial wastewater, Calcium, Sodium, Manganese, Nickel, Chlorides, Fluorides, Sulfates, Hardness, Biochemical oxygen demand, Chemical oxygen demand, Alkalinity.

Because the interest in coal slurry pipelining was initially concentrated in the west, there is little information available concerning the effects of slurry pipelining of eastern coal on water quality. Extensive water quality investigations were conducted using two eastern coals and various water sources to determine the coal-water relationships. The biochemical oxygen demand concentrations in slurry wastewaters were considerably less with eastern coal than western coal. The alkalinity concentrations in slurry wastewaters prepared with eastern coal were all low and tended to decrease with increasing detention time. The chemical oxygen demand concentrations were relatively low. Calcium and total hardness concentrations were very high in slurry wastewaters prepared with both eastern coals. The average chloride concentrations were 90 and 1,500 mg/1 for slurry wastewaters prepared with the Kansas and Illinois coals, respectively. Measurable quantities of fluoride and lead were present in the slurry wastewaters. Manganese and sodium concentrations were a function of coal source. Significant nickel concentrations were present in slurry wastewaters prepared with both eastern coals. The sulfate concentrations were high. (Moore-SRC)
W83-01273

EFFECTIVENESS OF SEPTIC SYSTEMS IN SAFEGUARDING THE GROUNDWATER IN MAINE,
Maine Univ. at Orono. Dept. of Plant and Soil Sciences.
For primary bibliographic entry see Field 5G.
W83-01278

INFLUENCE OF PARTICLE SIZE DISTRIBUTION ON WATER QUALITY IN AGRICULTURAL IMPOUNDMENTS,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
M. M. Ghosh, and T. Lochmoeller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-140020, Price codes: A09 in paper copy, A01 in microfiche. Completion Report, Sept 30, 1982. 185 p, 56 Fig, 14 Tab, 47 Ref, Append. OWRT A-132-MO(1), 14-34-0001-2127.

Descriptors: *Particle size distribution, Water quality, Sediment, Coagulation, Metals, *Missouri, Callahan Reservoir, Big River, Black River, *Lead, Path of pollutants, *Sediment measurement, *Mine wastes, Agricultural impoundments.

In recent years, the development of electric particle counters has created opportunities for more sensitive measurement of liquid-solid associations than has been possible previously. Very few particle size distribution (PSD) measurements have been made for natural systems. This research investigates the changes in PSD in a reservoir following storm events and the role PSD plays in transporting lead introduced into a river system by a mine tailings spill. The reservoir chosen for study is an agricultural flood retarding reservoir in central Missouri. Particle counting was by electrozone (coulter) method. Particle numbers vs. diameter, when plotted on log-log paper showed a linear relationship which can be characterized as a slope. A general pattern of change in the slope of PSD's following a storm was observed. Sediment-laden influents show relatively flat PSD slopes indicating a high percentage of large particles. Settling results in a steeper PSD slope. Gradually, PSD slopes become flatter, indicating the effect of coagulation. Additional PSD analyses were done for sediment samples from Big River in southeast Missouri in an effort to trace the fate of lead from mine tailings. Small particles control the transport of lead in Big River.
W83-01280

EVALUATION OF MICROCOSMS FOR DETERMINING THE FATE AND EFFECT OF BENZ(A)ANTHRACENE IN AQUATIC SYSTEMS,
Utah Water Research Lab., Logan.
J. G. Dickson, V. D. Adams, and D. B. George.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-140046, Price codes: A06 in paper copy, A01 in microfiche. UWRL Water Quality Series UWRL/Q-82/02, October, 1982. 95 p, 34 Fig, 8 Tab, 119 Ref. OWRT A-049-UTAH(1), 14-34-0001-0147.

Descriptors: Environmental quality, *Carcinogens, *Microenvironment, Contamination, Hydrocarbons, *Benz(a)anthracene, *Fate of pollutants, *Water pollution effects, *Aromatic hydrocarbons, *Biota, Pollutant identification, Industrial wastes.

Small scale, three-phase microcosms were used to study the aquatic fate and effect of a polycyclic aromatic hydrocarbon (PAH), benz(a)anthracene. This compound was chosen as a model for carcinogenic PAH because it is a typical constituent of petro-chemical effluents and has middle-of-the-range physical and chemical characteristics. In a series of experiments, techniques were established for monitoring the behavior and for assessing the biological response to the pollutant. Results indicate that benz(a)anthracene has no acute effect on aquatic organisms as indicated by the parameters used to measure community structure and function (gas productivity, nutrient utilization, biomass accumulation, and species composition). Gas chromatograph/mass spectral analysis of benz(a)antracene and metabolites in the medium sediment, and biota made it possible to trace the fate of the compound. At the end of one 60 day experiment, 76 percent remained in the sediment, 17 percent had been recovered in the medium, 1 percent had attached to the microcosm surfaces, and less than 1 percent was associated with the biota. Of the remaining 5 percent, a portion was photodegraded. There was no evidence of metabolism.
W83-01282

THE DEVELOPMENT OF PHYTOPLANKTON POPULATIONS AND NUTRIENTS IN A TIDAL RIVER UNDER DROUGHT CONDITIONS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Zoology.
M. A. Foote, and R. E. Loveland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-140053, Price codes: A06 in paper copy, A01 in microfiche. Completion Report, September, 1982. Division of Water Resources, Center for Coastal and Environmental Studies, Rutgers University. 110 p, 18 Fig, 3 Tab, 119 Ref. OWRT A-063-NJ(1), 14-34-0001-1132.

Descriptors: *Algae, *Diatoms, Plant populations, *Drought conditions, Water use, *New Jersey, *Nutrients, Tidal rivers, Path of pollutants, Pollutant identification, *Hackensack River, Water supplies, *Phytoplankton, *Organic enrichment.

Chemical and physical measurements were made at 6 stations along a 15 km segment of the upper Hackensack River from July 1980 to October 1981. Temperature, salinity, and concentrations of nitrate-nitrogen, ortho-phosphate, total hardness, alkalinity, silica and sulfate were all greater towards the lower end of the estuary. Dissolved oxygen concentrations were generally greater upstream. Ninety-nine species of planktonic algae were identified. Cell number/milliliter varied from 1080 to 240,000 during the course of the study and chlorophyll-a values varied from 1.33 to 270.9 mg/cubic meter. Additionally, 159 species of diatoms

were identified after acid-cleaning of the phytoplankton samples. The dominant species were centric forms. Diversity was measured using the Shannon Index. Diversity was slightly lower in the upper estuary during the summer months. Succession and algal periodicity are also discussed. Field work and literature searches were performed concerning the history, geology and vascular plants of the area. The Hackensack River as a source of potable water is also investigated.
W83-01283

WHAT'S IN THE WATER,
For primary bibliographic entry see Field 5A.
W83-01292

WATCHING THE RIVER'S FLOW.
Soil and Water, Vol. 17, No. 3, p 26-27, June, 1981. 1 Fig.

Descriptors: *Water pollution sources, *Rivers, *Industrial wastes, Tarawera River, Horticulture, Pulp and paper industry, Kawerau, *New Zealand, Color, Odor.

The Tarawera River (New Zealand) runs from Lake Tarawera to the sea. Between the Lake and Kawerau, the river remains relatively unpolluted. During the rest of its journey there are three main discharges made into its waters. The Caxton Paper Mill Ltd. discharges stormwater, water containing settling tank sludge, filter sludge, spent chemicals and clarified effluent. Another discharger is the Kawerau Borough Sewage Treatment Plant, with an estimated BOD loading of 150 kg/day. The third major discharger is the Tasman Pulp and Paper Company Plant. This third discharger is causing problems from both a pollution and an administrative point of view. In particular, an 80% reduction in color from Tasman's effluent would be needed before any noticeable improvement in the river would be observed. In the near future it is expected that horticulture will begin to be a major industry in this area, and thus cleanup of this river becomes all the more urgent. (Baker-FRC)
W83-01310

MOBILIZATION OF COPPER FROM MODIFIED PEAT BY DISSOLVED ORGANIC MATTER IN NATURAL WATERS AND BIOLOGICALLY PURIFIED WASTEWATERS,
Agricultural Univ., Wageningen (Netherlands). Dept. of Water Pollution Control.
J. Bovendeur, J. C. L. van Buuren, and J. A. Jacobs.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 15, No 4, p 181-186, August, 1982. 2 Fig, 3 Tab, 14 Ref.

Descriptors: *Copper, *Organic matter, *Chelation, Fate of pollutants, Sediments, Lake sediments, Effluents, Aeration, Peat, Organic compounds, *Dissolved organic carbon, *The Netherlands, Lake Tjeukemeer, Lake Nijkerkernauw.

Copper mobilization was studied in natural waters and wastewater effluents using a sulfuric acid-heat-modified peat containing 8 mg per g Cu to simulate organic matter in aquatic sediments. Water samples (200 ml) exposed to 50 mg Cu-containing organic matter for 24 hours at 0 C showed increased ability to mobilize Cu at higher levels of dissolved organic carbon. Secondary effluents mobilized more Cu than natural lake waters. Aeration also dramatically increased Cu mobilization. The mobilization capacities (micrograms Cu per mg dissolved organic carbon) were: Lake Tjeukemeer, 1.6-1.9: Lake Nijkerkernauw, 2.5-2.8; three secondary effluents (total of 11 samples), 2.3-7.0; anaerobically digested potato wastewater, 2.1; and aerated anaerobically digested potato wastewater, 9.9. The changes produced by aeration were the result of elimination of poorly-mobilizing materials and formation of organic compounds with better mobilizing properties. (Cassar-FRC)
W83-01341

EFFECTS OF WATER ON THE FATE OF HERBICIDES IN IRRIGATED SOILS,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
T. L. Lavy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146365, Price codes: A08 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Publication No 86, Fayetteville, August 24, 1982. 156 p, 26 Fig, 21 Tab, 65 Ref, 2 Append. OWRT B-057-ARK(1), 14-34-0001-8133.

Descriptors: *Herbicides, *Irrigation effects, *Leaching, *Soil water, *Pesticide kinetics, Metribuzin, Metolachlor, Fluometuron, Pendimethalin, Solubility, Adsorption, Pesticide residues, Fate of pollutants.

The wide use of soil-applied herbicides necessitates an understanding of their fate in soil if we are to use them in the most beneficial manner. All herbicides have some degree of water solubility and the field performance of many are dependent on ample, timely availability of soil moisture. It is important that different aspects of soil-herbicide-water interactions be thoroughly investigated. An excess use of water for irrigation purposes can result in the downward movement of herbicides in the soil profile. Subsoils are less adsorptive and a decreased degradation potential exists when herbicides move below the top 15 cm. In sandy soils, or other areas where extensive irrigation is planned it is prudent to attempt to choose a herbicide with high adsorptive capacity and low water solubility. Leaching of metribuzin, metolachlor, and fluometuron was an important dissipation process for each of the chemicals over the winter months when degradation was slow. Pendimethalin dissipation was greater in alternatively flooded and dried soil than with soil water content at 1/3 bar tension or with a continuous flood. In a laboratory degradation study, over 59% of the oxadiazon persisted after 20 weeks. In a greenhouse study its biological activity was reduced and its persistance increased when applied below the soil surface.
W83-01355

USEFULNESS OF SEDIMENT OXYGEN AS A TOOL FOR IMPOUNDMENT MANAGEMENT,
Illinois State Water Survey Div., Champaign.
M. J. Barcelona, and W. Wang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146761, Price codes: A03 in paper copy, A01 in microfiche. Research Report No 169, Univ. of Illinois, Urbana-Champaign, Water Resources Ctr., 1982. 40 p, 4 Fig, 7 Tab, 37 Ref. OWRT A-105-ILL(1), 14-34-0001-1115.

Descriptors: *Oxygen demand, *Sediment-water interfaces, *Oxygen sag, *Sulfides, Chemical oxygen demand, Oxygen requirements, Mud, Lake sediments, Aeration, Anaerobic conditions, Water pollution effects, Hydrogen sulfide, Mineralogy, *Illinois, *Sediment oxygen demand, Impoundments.

Sediment erosion and transport have a significant effect on water quality in agricultural watersheds. In the midwest there are many man-made impoundments which experience severe sediment-related problems. Sediment Oxygen Demand (SOD) measurements have great practical utility for the management of sediment-impacted lakes for which sediment dredging or aeration/destratification schemes represent viable rehabilitation schemes. The report summarizes a fifteen-month study of the phenomenon of SOD in shallow Illinois impoundments. Both lakes have served as public water supplies and experienced significant water quality problems associated with sediment accumulation or seasonal anoxia. The aims of the investigation were to identify the principal components of the SOD and to develop an optimized SOD procedure. Briefly, batch respirometric measurements of SOD were found to be most diagnostic of oxygen depletion due to sediment resuspension or disturbance. As such, the bulk of the demand could be identified as chemical, and associated with sediment solids rather than due to reduced soluble species in sediment pore waters. Sulfide minerals contributed to the SOD in nearly all cases. An improved method for the determination of acid-soluble sulfide was developed to permit correlation of sulfide levels with sulfidic SOD.
W83-01371

HEAVY METAL CONCENTRATIONS IN SHRIMP, CRAB, AND SEDIMENT OBTAINED FROM AD-DAMMAM SEWAGE OUTFALL AREA,
College of Petroleum and Minerals, Dhahran (Saudi Arabia). Research Inst.
M. Sadiq, T. H. Zaidi, A. ul-Hoda, and A. A. Mian.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 3, p 313-319, September, 1982. 3 Tab, 18 Ref.

Descriptors: *Invertebrates, *Heavy metals, *Sediments, Metals, Shrimp, Crabs, Fate of pollutants, Marine sediments, Outfalls, AD-Dammam, *Saudi Arabia, Arabian Gulf.

Concentrations of heavy metals in sediments and shellfish collected in June 1981 at the AD-Dammam, Saudi Arabia, municipal outfall in the Arabian Gulf were reported. Average concentrations of metals in shrimps and crabs (micrograms per g of wet tissue) and sediments (micrograms per g of sediment), respectively, were: Cd, 0.087, 0.043, 2.9; Cr, 0.059, 0.12, 18.1; Co, 0.98, 1.15, 23.9; Cu, 6.93, 12.32, 11.2; Ni, 0.54, 0.57, 28.6; Pb, 0.73, 1.32, 10.0; Zn, 32.02, 40.92, 22.2. (Cassar-FRC)
W83-01391

ENRICHMENT OF COPPER, ZINC, MANGANESE, AND IRON IN FIVE SPECIES OF PONDWEEKS (POTAMOGETON SPP.),
Turku Univ. (Finland). Dept. of Biology.
K. Aulio, and M. Salin.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 3, p 320-325, September, 1982. 2 Tab, 15 Ref.

Descriptors: *Aquatic plants, *Indicators, *Heavy metals, Metals, Copper, Zinc, Manganese, Iron, Enrichment, Kokemaenjoki River, *Finland, Estuaries, *Potamogeton, Fate of pollutants, Submerged plants, Macrophytes.

Average levels of heavy metals (micrograms per g dry weight) in 5 species of Potamogeton spp. growing in the heavily polluted Kokemaenjoki River Estuary, Finland, were: copper in P. perfoliatus (submerged), 39.7; P. obtusifolius (submerged), 44.5; P. natans (floating), 27.1; P. praelongus (submerged), 61.3; and P. gramineus (floating), 20.5. Concentrations of other metals (micrograms per g dry weight) using the same order of plant species were: Zn, 409.7, 190.8, 152.0, 228.9, and 123.8; Mn, 8372.9, 3704.5, 2643.5, 4985.6, and 4820.0; Fe, 3212.1, 5943.9, 1118.1, 9930.0, and 3537.5. Metals levels were much higher than previously reported values for pondweeds in unpolluted waters. Accumulation was species dependent. In general, submerged taxa had higher metals levels than floating-leaved species. The most promising indicator plant was P. perfoliatus, which had very high accumulations of Zn and Mn. (Cassar-FRC)
W83-01392

RECENT INCREASE IN MERCURY SEDIMENTATION IN A FOREST LAKE ATTRIBUTABLE TO PEATLAND DRAINAGE,
Joensuu Univ. (Finland). Karelian Inst.
H. Simola, and M. Lodenius.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 3, p 298-305, September, 1982. 4 Fig, 1 Tab, 30 Ref.

Descriptors: *Mercury, *Organic matter, *Drainage effects, Fate of pollutants, Lakes, Lake sediment, Sedimentation, Lake Polvijarvi, Lake Paajarvi, *Finland, Peat, Forest watersheds.

Mercury accumulation in sediments of a Finnish Lake increased as a result of draining peatlands and clearing farm fields. Sediment cores were taken from Lake Polvijarvi (eutrophied and surrounded by extensively drained peatland) and Lake Paajarvi (nearly oligotrophic). In Lake Polvijarvi Hg concentrations were: 1864-1920, 0.25 pm (back-

ground); 1967-1975, 0.3-0.5 ppm; and 1976-1980, 0.45 ppm. The profiles of ditching and clearing operations in the Polvijarvi watershed correlated with sidiment accumulation and Hg accumulation. Mobilization of soil Hg was probably the explanation for observed Hg level increases, since industrial and agricultural emissions of Hg were not significant. In Lake Paajarvi Hg concentrations varied from 0.032 to 0.088 ppm, in spite of sediment accumulation rates similar to those of Lake Polvijarvi. However, ditching operations in Paajarvi in the 1960's did not produce clearly noticeable Hg mobilization. Hg mobilization appeared related to the organic matter content of the sediments. Lake Polvijarvi sediments were much higher in organic matter than Lake Paajarvi sediments. On an organic matter basis the Hg concentrations of the two lakes were similar: 0.41-0.73 micrograms per g of organic matter in Lake Paajarvi and 0.50 micrograms per g of organic matter in Lake Polvijarvi (pre-1920's). (Cassar-FRC)
W83-01393

ACCUMULATION OF THE POLYCHLORINATED BIPHENYL AROCLOR 1242 FROM CONTAMINATED DETRITUS AND WATER BY THE SALTMARSH DETRITIVORE, UCA PUGNAX,
Marine Biological Lab., Woods Hole, MA. Ecosystems Center.
A. C. Marinucci, and R. Bartha.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 3, p 326-333, September, 1982. 3 Fig, 2 Tab, 17 Ref.

Descriptors: *Invertebrates, *Accumulation, *Polychlorinated biphenyls, Fate of pollutants, *Crabs, Detritus, Aroclors, Chlorinated hydrocarbons, Bioaccumulation, Organic compounds, Laboratory studies.

Male fiddler crabs (Uca pugnax) accumulated polychlorinated biphenyls (PCB's) as Aroclor 1242 from detritus at about 1 microgram PCB per day per animal and from water at 0.1 g PCB per day per animal. The detritus contained 17 ng per g wet weight or 85 ng per g dry weight PCB. Uptake of PCB was rapid. By the tenth day of exposure essentially all the PCB had been accumulated (about 8 micrograms PCB per crab). A second feeding at day 20 resulted in a further rapid accumulation to 22 micrograms PCB per crab at day 27. The hepatopancreatic tissue had about 10 times the PCB concentrations of the whole animals and chela tissue. Total PCB accumulation was independent of the weight of the animal, but PCB concentration in the animal was inversely related to animal weight. PCB uptake from water was about half that from detritus plus water after 34 days. (Cassar-FRC)
W83-01394

A STUDY OF WELL WATER IN SELECTED CALIFORNIA COMMUNITIES FOR RESIDUES OF 1,3-DICHLOROPROPENE, CHLOROALLYL ALCOHOL AND 49 ORGANOPHOSPHATE OR CHLORINATED HYDROCARBON PESTICIDES,
California Dept. of Food and Agriculture, Sacramento.
K. T. Maddy, H. R. Fong, J. A. Lowe, D. W. Conrad, and A. S. Frederickson.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 3, p 354-359, September, 1982. 4 Tab, 7 Ref.

Descriptors: *Pesticide residues, *Organophosphorus pesticides, *Chlorinated hydrocarbons, *Pollutant identification, Insecticides, *California, 1,2-Dichloropropene, Chloroallyl alcohol, Agricultural chemicals, Fate of pollutants.

No pesticide residues were found in water from 54 municipal and private wells (depths 65 to 1200 ft) in the San Joaquin area of California. All wells, in use for 15 or more years, were in an area of high pesticide use. Minimum detectable levels were: 1,3-dichloropropene, 0.1 ppb; chloroallyl alcohol, 0.6 ppb; 27 organophosphates, 5.0 ppb; and 22 chlorinated hydrocarbons, 5.0 ppb. (Cassar-FRC)
W83-01396

5C. Effects Of Pollution

CHRYSOPHYCEAE FROM SOME GREEK LAKES,
Copenhagen Univ. (Denmark). Inst. of Plant Anatomy and Cytology.
J. Kristiansen.
Nova Hedwigia, Vol 33, No 1-2, p 167-194, 1980. 45 Fig, 44 Ref.

Descriptors: *Chrysophyta, *Algae, *Greece, *Lakes, *Subtropic zone, *Spatial distribution, *Population density, Phytoplankton, Hydrobiology, Ochromonas, Diatoms, Climatic zones, Tropic level, Species composition.

Studies were made of the Chrysophyceae of 5 Greek Lakes. Electron microscope evaluations of the species found showed that the lakes examined have very different chrysophycean flora. Lakes Pamvotis, Lysimachia, and to some extent, Lake Ozeros were found to be rich in chrysophyceae, while Lakes Amvrakia and Trichonis were very poor. These differences did not seem to be related to trophic level. Much of the previous work on Chrysophyceae had connected these algae with northern temperature, subarctic and arctic zones. The present investigation clearly indicates an abundance of these algae in Mediterranean climates. Many of the 30 species found during the present study are widely distributed; only 9 species were considered rare. Eight species have been found only in Europe. Since so few Greek lakes have been examined for Chrysophyceae, and only in March-April, it is likely that many more of these algae will be found in further investigations. (Geiger-FRC)
W83-01064

ALGAL GROWTH STIMULUS BY PHOSPHORUS IN FLATHEAD LAKE, MONTANA, SEDIMENTS,
Montana Univ., Flathead Lake. Biological Station.
W. B. Perry, and J. A. Stanford.
Northwest Science, Vol 56, No 1, p 48-52, 1982. 1 Fig, 1 Tab, 15 Ref.

Descriptors: *Sedimentation, *Phosphorus, *Algae, Adsorption, *Oligotrophic lakes, Selenastrum capricornutum, Bioassays, Growth rates, Nutrients, Lakes, Flathead Lake, *Montana, Lake sediments, Bottom sediments.

Sediments from oligotrophic Flathead Lake, Montana, stimulated more than double the growth of Selanastrum capricornutum compared to control cultures to which no sediment was added. Phosphorus, nitrogen, and other nutrients were apparently available to the algae under laboratory conditions. In the lake, growth stimulation does not occur, because the sediment quickly settles to the bottom (mean depth, 50.2 m) out of contact with the algae in the photic zone. In addition, anaerobic conditions, which favor P release from sediments, do not occur in this lake. Resuspension is confined to near-shore areas. Therefore, clay sediments entering the lake during spring runoff act as a permanent sink for P. (Cassar-FRC)
W83-01065

ZONATION OF INSHORE BENTHOS OFF A SEWAGE OUTFALL IN HAWKE BAY, NEW ZEALAND,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
G. A. Knox, and G. D. Fenwick.
New Zealand Journal of Marine and Freshwater Research, Vol 15, No 4, p 417-435, 1981. 13 Fig, 5 Tab, 54 Ref.

Descriptors: *Benthos, *Wastewater disposal, *Outfall sewers, Wastewater outfall, Hawke Bay, Bay, Aquatic life, Water pollution effects, Benthic environment, *New Zealand.

A baseline was sought for monitoring changes in the benthos off a sewage outfall in Hawke Bay. The bay is a large shallow waterbody on the east coast of the North Island of New Zealand. At the study site the bottom slopes steadily from about 4 meters to about 17 meters in depth at the outer stations. A strong inflow of water along the mid line of the bay was noted which diverges to flow around the bay's margins. The steep sand-shingle beach in this part of Hawke Bay reflects the importance of wave action in the nearshore environment. Crustacea and Polychaeta contributed most of the 100 species found. Most individuals were polychaetes. Five groups of species were found. Five faunal zones parallel to shore and progressively wider further offshore were distinguished. Community structure increased offshore, and faunal density decreased offshore from the second zone. Inshore zones were obviously polluted, with the capitellid Heteromastus filiformis occurring in densities up to 36,950 per square meter 500 meters from shore. Furthest from shore, the fauna was more normal with Heteromastus densities of 6000 per square meter. Unique to New Zealand shores is a dense zone of holothurians at 8-10 meter depths. Deposit feeders dominated all stations whereas suspension feeders dominated the benthos of coarser sediments. (Baker-FRC)
W83-01085

THE LOCH EIL PROJECT: ASSESSMENT AND SYNTHESIS WITH A DISCUSSION OF CERTAIN BIOLOGICAL QUESTIONS ARISING FROM A STUDY OF THE ORGANIC POLLUTION OF SEDIMENTS,
Dunstaffnage Marine Research Lab., Oban (Scotland).
T. H. Pearson.
Journal of Experimental Marine Biology and Ecology, Vol 57, No 1, p 93-124, 1982. 3 Fig, 8 Tab, 54 Ref.

Descriptors: *Organic matter, *Pulp and paper industry, *Benthic fauna, Water pollution effects, Fjords, Estuaries, Loch Eil, *Scotland, Invertebrates, Sediments, Nutrients, Fate of pollutants, Cellulose, Phytoplankton, Plankton, Sedimentation, Bacteria, Seasonal variation, Biomass.

Results of 11 published studies on the effects of pulp and paper mill effluents on Loch Eil, Scotland, a fjordic system, are summarized. The cellulosic paper mill wastes comprised 67-95% of the total annual carbon input (290 g C per sq m) to the system. Several general conclusions were reached as a result of analyzing the physical, chemical, and biological variables: (1) nutrient regeneration from the sediments plays an important part in stimulating productivity in the water column, (2) organic carbon does not accumulate on a long-term basis, (3) a 10-fold increase in carbon input to the sediments has little effect on bacterial biomass but increases protozoan biomass 100-fold, doubles the small metazoan biomass, and increases macrofaunal biomass, for an overall halving of biomass, (4) macrofauna activities do not control microbial activity levels in sediments under high organic inputs but have a critical effect on microbial systems under low organic input conditions, and (5) perturbations of the ecosystem are temporary in this inherently stable loch system. (Cassar-FRC)
W83-01086

THE LOCH EIL PROJECT: PLANKTONIC PIGMENTS IN SEDIMENTS FROM LOCH EIL AND THE FIRTH OF LORNE,
Dunstaffnage Marine Research Lab., Oban (Scotland).
P. Tett.
Journal of Experimental Marine Biology and Ecology, Vol 56, No 1, p 101-114, 1981. 7 Fig, 2 Tab, 38 Ref.

Descriptors: *Organic matter, *Plant pigments, *Pulp and paper industry, Water pollution effects, Estuaries, Fjords, Loch Eil, Firth of Lorne, *Scotland, Phytoplankton, Sediments, Chlorophyll, Pigments, Anaerobic conditions, Seasonal variation, Sedimentation.

Photosynthetic pigments and their derivatives were determined in sediments collected in Loch Eil and the Firth of Lorne, Scotland, during November 1975 to November 1976. Pigments were separated into two fractions, chlorophyll (chlorophyll a + chlorophyllide a) and phaeopigment, by

fluorescence change on acidification. Highest pigment levels (mean 73 micrograms per g sediment dry weight) and highest percentage of chlorophyll (23%) were found in the most reducing sediments (Eh, +74 mV), which were associated with high organic matter input from a pulp and paper mill discharge. The lowest mean pigment concentrations (23 micrograms per g sediment dry weight) and lowest percentage of chlorophyll (17%) were found in the oxidizing sediments (Eh, +426 mV) in the Firth of Lorne, unaffected by the paper mill wastes. In the Firth of Lorne sediments a seasonal cycle was observed in pigment levels, with maxima in pigment concentrations and chlorophyll % in May-June, directly following the plankton spring increase. In the Loch Eil sediments seasonal cycles of pigment levels were less evident at stations moderately impacted by paper mill effluents. At the most polluted station sediment pigment concentrations varied widely, with no apparent seasonal patterns. The rate of pigment breakdown was lower at polluted stations. There was no correlation between sediment pigment content and the content and sedimentation rate of the phytoplankton pigments in overlying water. (Cassar-FRC)
W83-01087

AEROMONAS HYDROPHILA ENCOUNTERED DURING SURVEY OF LEPTOSPIRAE IN PRAWN FARM POND WATER,
Hawaii State Dept. of Health, Honolulu.
H. H. Higa, T. R. Sawa, V. T. Sato, J. A. Brock, and S. F. Perri.
Journal of Environmental Health, Vol 45, No 1, p 20-23, July/August, 1982. 1 Fig, 2 Tab, 17 Ref.

Descriptors: *Aquaculture, *Aeromonas, *Bacteria, Pathogens, Water pollution sources, *Hawaii, Oahu.

Aeromonas spp. was found in dead hamsters inoculated with water from a prawn aquaculture pond on Oahu, Hawaii. The study had been designed to survey for leptospirae. Of the 576 hamsters in the study, 132 died within 96 hours after inoculation. Examination of 33 of the dead animals revealed Aeromonas spp. in 33.3% of the brains and 100% of the spleens. Aeromonas hydrophila was identified in isolates from 13 of the 33 animals. These organisms pose a potential health threat to prawn pond workers. (Cassar-FRC)
W83-01089

EPIDEMIOLOGY OF ELTOR CHOLERA IN RURAL BANGLADESH: IMPORTANCE OF SURFACE WATER IN TRANSMISSION,
Centers for Disease Control, Atlanta, GA.
J. M. Hughes, J. M. Boyce, R. J. Levine, M. Khan, and K. M. A. Aziz.
Bulletin of the World Health Organization, Vol 60, No 3, p 395-404, 1982. 1 Fig, 9 Tab, 20 Ref.

Descriptors: *Public health, *Epidemiology, *Bacteria, *Cholera, *Bangladesh, Vectors, Disease vectors, Vibrio, Vibrio cholerae.

To define the role of water used for drinking, cooking, bathing, and washing in the transmission of Vibrio cholerae biotype eltor infections in an area with endemic cholera, surveillance was initiated in neighborhoods with a culture-confirmed cholera index case and others with index cases with non-cholera diarrhea as controls. In neighborhoods with cholera infection, 44% of the surface water sources were positive for V. cholerae, whereas only 2% were positive in control neighborhoods. Canals, rivers, and tanks were most frequently positive. An increased risk of infection existed in families using water from culture-positive sources for drinking, cooking, bathing, or washing and for those using water sources used by index families for cooking, drinking, or bathing. For families drinking from a culture negative source, there was an association between infection and bathing in a positive source. These and other data suggested that use of surface water is important in the transmission of V. cholerae and that, in addition to providing safe drinking water, education regarding the risk of transmission of infection by water from potentially contaminated sources used for other purposes, especially bathing, may also be necessary to control transmission in areas where eltor cholera is endemic. (Baker-FRC)
W83-01107

FACTORS AFFECTING THE DISTRIBUTION OF THE BIVALVE, MACOMA BALTHICA (L.) ON A MUDFLAT RECEIVING SEWAGE EFFLUENT, FRASER RIVER ESTUARY, BRITISH COLUMBIA,
E.V.S. Consultants Ltd., Vancouver (British Columbia).
E. R. McGreer.
Marine Environmental Research, Vol 7, No 2, p 131-149, 1982. 5 Fig, 8 Tab, 30 Ref.

Descriptors: *Estuarine environment, *Mollusks, *Wastewater disposal, Effluents, Wastewater treatment, Water treatment facilities, Water pollution sources, Marshes, Fraser River, Mudflats, Intertidal areas, Effects of pollution, Population dynamics, *British Columbia.

An investigation of the factors responsible for the distribution of Macoma balthica (L.) on a mudflat receiving sewage effluent was carried out in the Fraser River estuary, British Columbia. The factors examined included reduced salinity, low levels of dissolved oxygen, effluent toxicity, chlorination, substrate grain size and the effects of metal contaminated sediments. Results showed that salinity, dissolved oxygen and sediment grain size did not satisfactorily explain the distribution of M. balthica. Unchlorinated and chlorinated sewage effluent were shown to be nontoxic in laboratory tests, and these results were confirmed by 7-day in situ bioassays. The factor which appeared to determine the distribution of M. balthica was the degree of contamination of the substrate, which affected the settling and survival of larval and juvenile clams. Heavy metals occurred in high concentrations in the contaminated sediments and were considered to be the most probable controlling factor. (Baker-FRC)
W83-01127

NUTRIENT ENRICHMENT OF SEAGRASS BEDS IN A RHODE ISLAND COASTAL LAGOON,
Rhode Island Univ., Kingston. Dept. of Botany.
M. M. Harlin, and B. Thorne-Miller.
Marine Biology, Vol 65, No 3, p 221-229, 1981. 3 Fig, 9 Tab, 33 Ref.

Descriptors: *Nutrients, *Lagoons, *Sea grasses, Saline lakes, *Rhode Island, Nitrogen, Phosphorus, Algal growth, Coastal lakes, Phytoplankton, Epiphytes, Aquatic weeds, Aquatic plants, Ammonium.

The possibility that adding low concentrations of potentially limiting nutrients in situ could alter the balance of four plant components: seagrasses, seaweeds, epiphytic flora, and phytoplankton, was investigated. Seagrass and algal beds showed a variety of responses when the water column was treated with low level additions of ammonium, nitrate and phosphate. Ammonium caused the production of dense mats of free floating green algae. It also stimulated growth in both the leaf and root-rhizome fractions of Zostera marina, particularly in areas where the current speed reached 12 cm/sec. The concentration of nitrogen in the tissue did not change. Nitrate additions enhanced growth of the green seaweeds Enteromorpha spp. and U. lactuca, but not Z. marina or R. martima. Phosphate enhanced growth in Z. marina and R. maritima exposed to moderate current. G. tikvahiae growing alone showed a small growth response to phoshate. The phosphate made no difference in the growth of the green seaweeds. None of the nutrient supplements noticably altered the species composition of either epiphytic or planktonic algae associated with the beds, although small increases in their numbers were detected. The rapid and dense growth of green algae in nitrogen enriched water probably limited growth of adjacent seagrasses and red algae. Because these seaweeds did not use the phosphate, it became available to other plant components. The overall floral response to nutrient addition in seagrass communities depends on the particular nutrient supplied, the ability of alternate species in the area to compete for that nutrient, and the velocity of current in the specific area. (Baker-FRC)
W83-01129

RESPONSES OF EXPERIMENTAL ESTUARINE COMMUNITIES TO CONTINUOUS CHLORINATION,
Environmental Research Lab., John's Island, SC. Bears Bluff Field Station.
P. F. Sheridan, and A. C. Badger.
Estuarine, Coastal and Shelf Science, Vol. 13, No. 3, p 337-347, September, 1981. 6 Tab, 29 Ref.

Descriptors: *Estuarine environment, *Benthos, *Chlorination, Chlorine, *South Carolina, Estuaries, Plankton, Productivity, Temperature effects, Weather.

The effects of continuous chlorination on estuarine benthic organisms were investigated using plankton derived experimental communities. Twelve consecutive studies were conducted, each of which consisted of about 60 day colonization periods from flowing estuarine waters that continuously received nominal concentrations of 0.00, 0.47, 0.94 or 1.41 mg chlorine-produced oxidant (CPO)/liter. Chlorination had an inconsistent impact on the colonization and development of estuarine communities. Short-term seasonal effects occurred sporadically, but included elimination of dominant species (Molgula, Ampharete), replacement of one dominant species by another (Melita by Pista or Pista by Nereis), and the interaction of extreme cold weather with chlorination to produce higher toxicity. Analysis of the pooled data from 12 consecutive studies showed no chlorination effects on numbers of species recorded and only two species whose proportional contributions to the total faunas were significantly reduced by chlorination. A general decline in the total numbers of individuals recorded was caused by chlorination. The findings of inconsistent chlorination impact may be due to several factors, including small numbers of colonizing organisms, short colonization periods and water quality parameters such as salinity, ammonia content and entrained organics which were not controlled. There was a lack of a linear or gradient response by developing communities to increasing CPO levels. Instead, an abrupt 38 to 44% decline in numbers was noted in chlorinated systems as compared to controls. (Baker-FRC)
W83-01131

AVON-HEATHCOTE, ESTUARY UNDER STRESS,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W83-01149

PRIMARY PRODUCTION IN A TURBID ESTUARY,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 2L.
W83-01155

EFFECTS OF RESIDENTIAL WASTEWATER-TREATMENT SYSTEMS ON GROUND-WATER QUALITY IN WEST-CENTRAL JEFFERSON COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
D. C. Hall, D. E. Hillier, E. Nickum, and W. G. Dorrance.
Geological Survey Open-File Report 81-73 (WRI), 1981. 65 p, 8 Fig, 19 Tab, 70 Ref.

Descriptors: *Groundwater, *Water quality, *Water pollution effects, *Septic tanks, Aquifers, Aerobic treatment, Effluents, Degradation, Nitrates, Chemical analysis, Well data, Observation wells, Sites, *Colorado, Jefferson County.

The use of residential wastewater-treatment systems in Evergreen Meadows, Marshdale, and Herzman Mesa, Colo., has degraded ground-water quality to some extent in each community. Age of

community; average lot size; slope of land surface; composition, permeability, and thickness of surficial material; density, size, and orientation of fractures; maintenance of wastewater-treatment systems; and presence of animals are factors possibly contributing to the degradation of ground-water quality. When compared with effluent from aeration-treatment tanks, effluent fom septic-treatment tanks is characterized by greater biochemical oxygen demand and greater concentrations of detergents. When compared with effluent from septic-treatment tanks, effluent from aeration-treatment tanks is characterized by greater concentrations of dissolved oxygen, nitrite, nitrate, sulfate, and dissolved solids. (USGS)
W83-01182

EFFECT OF ELEVATED WATER TEMPERATURE ON MACROINVERTEBRATE COMMUNITIES IN OUTDOOR EXPERIMENTAL CHANNELS,
Environmental Protection Agency, Monticello, MN. Ecological Research Station.
J. W. Arthur, J. A. Zischke, and G. L. Ericksen.
Water Research, Vol 16, No 10, p 1465-1477, October, 1982. 8 fig, 3 Tab, 24 Ref.

Descriptors: *Temperature effects, *Macroinvertebrates, *Population dynamics, Physical properties, Seasonal variation, Channels, Powerplants, Heated water, Thermal pollution, *Mississippi River, Minnesota.

Macroinvertebrates were sampled monthly from December 1976 to September 1977 in two 520 m long outdoor experimental channels. One channel was maintained at ambient seasonal Mississippi River water temperatures and the other at 10 C higher. Maximum water temperature reached 31.0 C in the ambient and 40.8 C in the heated channel. Elevated temperature seasonally altered macroinvertebrate abundance and life history in the channels. Few animals were found in the heated channel during the period of maximum water temperature. Most macroinvertebrate density and composition differences were confined to the channel riffles rather than the pools. Peak total density in the heated channel riffles occurred 3 or 4 weeks before the ambient channel. Total macroinvertebrate density was appreciably higher in the heated channel riffles during the winder and spring months and in the ambient channel riffles during the summer months. This seasonal alteration was due to composition differences of several identified taxa. Reproductive periods for one snail and one isopod species began about 2 and 3 months earlier respectively in the heated channel than in the ambient channel. No marked change occurred in the reproductive activities of an amphipod in the two channels. (Baker-FRC)
W83-01195

SIMPLE TROPHIC STATE CLASSIFICATION OF THE CANADIAN NEARSHORE WATERS OF THE GREAT LAKES,
Canada Centre for Inland Water, Burlington (Ontario).
D. J. Gregor, and W. Rast.
Water Resources Bulletin, Vol 18, No 4, p 565-573, August, 1982. 4 Fig, 3 Tab, 25 Ref.

Descriptors: *Water quality, *Great Lakes, *Nearshore processes, *Trophic level, *Phosphorus, *Nutrients, *Chlorophyll a, *Mathematical studies, Impaired water quality, Water pollution, Eutrophication, Lakes, Oligotrophy, Turbidity, Opacity, *Lake classification, *Composite Trophic Index, Indicators, Bioindicators.

A trophic classification of the Canadian nearshore waters of the Great Lakes was carried out utilizing data on summer surface water quality for the early 1970's. A general Composite Trophic Index was generated using paired linear relationships for total phosphorus, chlorophyll a, and Secchi depth data for 66 defined regions. Nearshore waters were found to contain a lower chlorophyll a concentration for a given total phosphorus concentration than observed for the open water areas of the Great Lakes or for smaller Canadian lakes. The most eutrophic conditions were found in areas of restricted circulation and/or high nutrient loading such as the Bay of Quinte, Toronto, Hamilton harbors, and parts of the western basin of Lake Erie. Except for some embayments, Lakes Huron and Superior are mostly oligotrophic. The Composite Trophic Index eliminates biases introduced through the use of a single trophic state indicator and is useful in describing nearshore water quality in terms generally comparable to other water bodies. (Geiger-FRC)
W83-01199

PATHOGENIC AMOEBAE IN OCEAN SEDIMENTS NEAR WASTEWATER SLUDGE DISPOSAL SITES,
National Marine Fisheries Service, Oxford, MD.
T. K. Sawyer, E. J. Lewis, M. Galassa, D. W.. Lear, and M. L. O'Malley.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1318-1323, September, 1982. 2 Fig, 3 Tab, 21 Ref.

Descriptors: *Amebas, *Marine sediments, *Sludge disposal, Pathogens, Ocean dumping, Sediments, Fate of pollutants, Disposal, *Middle Atlantic Bight, Microorganisms, Bacteria, Parasites, Coliforms, Indicators.

Acanthamoeba species were found in 17.5% of 229 ocean bottom sediment samples collected in the vicinity of the Philadelphia-Camden wastewater sludge disposal site, 64 km seaward from Maryland, between April 1978 and August 1980. Amebas were distributed 37-40 km northeast and southwest of the dumpsite center and 10 km to the east and west. 50-75% of sediment samples containing coliforms and streptococci also contained amebas, indicating a similar distribution pattern for bacteria and amebas. Two of the 6 ameba species, A. culbertsoni and A. hatchetti, killed laboratory mice. A. hatchetti was found at 17 stations and A. culbertsoni at 2. A. polyphaga (found at 14 stations), A. castellanii, A. rhysodes, and A. triangularis are not considered pathogenic. (Cassar-FRC)
W83-01216

ACID DEPOSITION,
B. Hileman.
Environmental Science and Technology, Vol 16, No 6, p 323A 327A, June 1982. 4 Fig.

Descriptors: *Acid rain, *Lakes, *Sulfur compounds, *Path of pollutants, Pollutants, Water quality, Water properties, Fish, Aquatic animals, Bioindicators, Geography, Hydrogen ion concentration, Forests, Leaching, Seepage, Sucker, Trout, Minnow, Precipitation, Rainfall, Chemistry of precipitation.

Papers presented at the American Chemical Society's symposium on acid precipitation (March 29 to April 2, 1982) are summarized. It was shown that a pH isopleth of 4.5 encloses an area of the U.S. and Canada that is in general symmetrical about and displaced somewhat to the northeast of states with high sulfur dioxide emissions. Across the north central lake states the acidity concentration gradient is almost the same as that which existed in Scandinavia when lakes there became acidified. The extent of injury caused by acid rain in lakes is much greater than the killing of fish, and other negative effects precede fish disappearnce. A study of about 2,000 observations on the tolerance of aquatic organisms to acidity revealed that fish and amphibians are the most tolerant and leeches and mollusks the least. Experimental acidification of a small precambrian shield lake showed that fathead minnows died out first at a pH of about 5.5, while lake trout and white suckers showed no stress till pH of about 5.1. In 12 seepage lakes, 6 of which were acidic, species richness of fish was much less in the acidic lakes, and minnows were significantly fewer here. In surface waters a reduction in pH is accompanied by high manganese concentrations and indicates the release of other heavy metals into the water. Increased manganese and aluminum concentrations were found in fish in acidified lakes. Some models for water chemistry were presented, but as yet these tend to describe an existing state rather than to predict what acid inputs would cause a given change in chemistry. Several papers were given on the chemical processes of acidification of precipitation and on long-range transport. (Gish-FRC)
W83-01217

POTENTIAL EUTROPHICATION OF THE RIDEAU RIVER BY AN URBAN WATERWAY: DISCUSSION,
Gore and Storrie Ltd., Toronto (Ontario).
M. D. Palmer.
Canadian Journal of Civil Engineering, Vol 9, No 2, p 353-356, June, 1982. 3 Fig, 19 Ref.

Descriptors: *Eutrophication, *Rivers, *Nutrients, Temperature effects, Sawmill Creek, Rideau River, Storm runoff, Phosphorus, Urban watersheds, Seasonal variation, Nitrogen, *Ontario.

In a paper published in Canadian Journal of Civil Engineering, Vol. 8, p 165-172, M. H. Habicht, K. Adamowski and A. C. Middleton attempted to ascertain whether nutrients contributed by Sawmill Creek can exert a significant effect on algal growth in the Rideau River. Total phosphorus and total nitrogen concentrations were measured in Sawmill Creek, a major Rideau River tributary, during storm events, and similar measurements were made in the receiving stream upstream from tributary outlet. Jar growth algae tests were carried out in the laboratory, wherein various strengths of tributary water were mixed with the receiving water. The algal biomasses in the jars after 6 days were tested statistically. The tributary water significantly increased the biomass in the jars. The present author points out that river flow data for the Rideau River are very complex and are largely controlled by an upstream dam at Hog's Back. Potential eutrophication is probably a function of loading rate and flushing times, not simply of concentrations. It is also probable that physical mixing (turbulence), turbidity, and resuspension are factors for stormwater. Sediment exchange processes are important when considering total phosphorus budgets. Measurements in the Rideau River show Secchi disc values of 0.5-2.2 m and an attenuation coefficient using a submerged submarine photometer of 2.1/m. According to these data, it appears probable that light limitation is a factor in the eutrophication of the River. The normal low river velocities during summer, averaging between 4 and 6 cm/sec, would suggest that physical mixing is not a factor during these dry periods. Sawmill Creek water is invariably colder than Rideau River water, which may account for the lower nutrient stormwater concentrations found. Consequently, stormwater will sink in the Rideau River, and river mixing will be a factor in the total phosphorus storm loadings from Sawmill Creek to the Rideau River. (Baker-FRC)
W83-01219

PHYTOPLANKTON COMPOSITION AND DISTRIBUTION AS AN EXPRESSION OF PROPERTIES OF RESERVOIRS,
Barcelona Univ. (Spain). Dept. of Ecologia.
For primary bibliographic entry see Field 2H.
W83-01224

FATE OF POLYCHLORINATED BIPHENYLS (PCBS) IN SOIL PLANT SYSTEMS,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W83-01235

EFFECTS OF A HEXACHLOROBIPHENYL AND PENTACHLOROPHENOL ON GROWTH AND PHOTOSYNTHESIS OF PHYTOPLANKTON,
New York State Dept. of Health, Albany. Environmental Health Center.
I. J. Gotham, and G. Y. Rhee.
Journal of Great Lakes Research, Vol. 8, No. 2, p 328-335, 1982. 6 Fig, 29 Ref.

Descriptors: *Chlorinated hydrocarbons, *Phytoplankton, *Photosynthesis, *Growth rates, *Hexachlorobiphenyl, Pentachloropheno, *Phenols, Organic compounds, Water pollution effects, Fate of

pollutants, Accumulation, Bioaccumulation, Algae, Inhibition, *Ankistrodesmus falcatus, *Melosira, *Microcystis, Lake Huron, Great Lakes.

The effects of two organochlorine compounds, 2,4,5,2',2',5'-hexachlorobiphenyl (HCB) and pentachlorophenol (PCP), on algal photosynthesis and growth were studied in semicontinuous cultures of Ankistrodesmus falcatus, Melosira sp., and Microcystis sp. Concentrations were: HCB, 0.5-1.0 micrograms per liter; PCP, 1.0-1.3 micrograms per liter. HCB stimulated photosynthesis in Ankistrodesmus and Melsosira, both per cell and per unit of chlorophyll. Average cell concentrations of HCB were 3 times 10 to the minus 5th power and 6 times 10 to the minus 6th power ng per cell, respectively. HCB significantly inhibited the growth rate of Melosira, but no trend in Ankistrodesmus growth was apparent. HCB was not tested on Microcystis. PCP inhibited photosynthesis in Ankistrodesmus and Microcystis, both per cell and per unit of chlorophyll. Cell concentrations of PCP were 4-8 times 10 to the minus 7th power and 2-11 times 10 to the minus 8th power ng per cell, respectively. PCP inhjibited phjotosynthesis in Melosira at 2-6 times 10 to the minus 7th power ng per cell. Melosira growth rates were significantly depressed by PCP. Growth rates of Ankistrodesmus and Microcystis in PCP showed no statistical trends. (Cassar-FRC)
W83-01242

OVERVIEW OF PHYTOPLANKTON CONTAMINANT PROBLEMS,
New York State Dept. of Health, Albany. Environmental Health Center.
For primary bibliographic entry see Field 5B.
W83-01243

FIELD AND LABORATORY STUDIES OF THE TOXICITY OF PHYTOPLANKTON OF POLYCHLORINATED BIPHENYLS (PCBS) DESORBED FROM FINE CLAYS AND NATURAL SUSPENDED PARTICULATES,
Oak Ridge National Lab., TN. Environmental Sciences Div.
C. D. Powers, G. M. Nau-Ritter, R. G. Rowland, and C. F. Wurster.
Journal of Great Lakes Research, Vol. 8, No. 2, p 350-357, 1982. 4 Fig, 2 Tab, 32 Ref.

Descriptors: *Phytoplankton, *Polychlorinated biphenyls, *Sediments, Adsorption, Water pollution effects, *Toxicity, Sediments, *Aroclors, Chlorinated hydrocarbons, *Clays, Particulate matter, *Suspended sediments, Photosynthesis, Chlorophyll a, Diatoms, Algae, New York Bight.

Particulates with adsorbed polychlorinated biphenyls (PCB's), as Aroclor 1254, released enough toxic substance upon description in the presence of diatoms and natural phytoplankton assemblages to adversely affect photosynthesis, growth rates, and chlorophyll a levels. Laboratory studies used illite and New York Bight sediment treated with C14-labelled Aroclor 1254 and two diatom cultures, Thalassiosira pseudonana and T. weissflogii. Field studies in dialysis bags suspended in the tidal channel of an estuarine marsh used Hudson River particulates and natural phytoplankton assemblage. The cultures containing 90 micograms per liter of illite-bound PCB were heavily damaged within 4 hours, by which time 72% of the PCB had desorbed from the clay and dissolved in the water. When PCB-containing particles were removed after equilibration with water and before addition of algae, enough dissolved PCB remained in the water to reduce growth rates and chlorophyll a content of the culture. In the field test (50 micrograms per liter of sediment-associated PCB) photosynthesis and chlorophyll a were adversely affected for 3 days. (Cassar-FRC)
W83-01244

EFFECTS OF SURFACE FILMS ON AIR-WATER EXCHANGE RATES,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
D. Mackay.
Journal of Great Lakes Research, Vol 8, No 2, p 299-306, 1982. 3 Fig, 2 Tab, 20 Ref.

Descriptors: *Air-water interfaces, *Films, *Volatility, Model studies, *Organic compounds, Mass transfer, Surface films, Hydrodynamics, Diffusivity, Fate of pollutants, Waves, Resistance, Evaporation.

A model for describing the effects of surface films (in particular, organic contaminants) on the rate of air-water exchange is based on two additive retarding effects. The hydrodynamic effect, which slows turbulence, is identified by changes in drag coefficient, friction velocity, and surface roughness. The diffusive resistance effect depends on the diffusivities or mass transfer coefficients of water, film, and air and the fugacity capacities. The model results aagreed with experimental data. However, further testing is necessary for films of different thickness and known composition using solutes covering a range of fugacity capacities. The model describes only diffusive transfer and does not consider spray transfer or wet and dry deposition. (Cassar-FRC)
W83-01262

SHORT CYCLING OF CONTAMINANTS BY ZOOPLANKTON AND THEIR IMPACT ON GREAT LAKES ECOSYSTEMS,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
For primary bibliographic entry see Field 5B.
W83-01263

EVALUATION OF MICROCOSMS FOR DETERMINING THE FATE AND EFFECT OF BENZ(A)ANTHRACENE IN AQUATIC SYSTEMS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 5B.
W83-01282

RIVER WATER QUALITY FOR BATHING PURPOSES,
Benaras Hindu Univ., Varanasi (India). Inst. of Tech.
M. S. Narayanaswamy.
Journal of the Institution of Engineers (India), Part EN, Environmental Engineering Division, Vol. 62, No. 2, p 59-63, February, 1982. 1 Tab, 27 Ref.

Descriptors: *Water quality, Bacteria, *Bathing, *India, Public Health, Coliforms, Wastewater disposal, Wastewater treatment, Path of pollutants.

Community bathing in rivers, as a traditional religious activity, is indispensable to the people of India. Public health risks are involved for those who bathe in the rivers polluted due to discharge of untreated or partially treated domestic sewage. The primary concern is caused by the presence of pathogens. Their numbers decrease in the natural aquatic environment due to several physico-chemical and biological factors. However, the bacteria Salmonella typhi survives for one to four days in raw river waters and two days in drainage canals. The Indian Standards Institution should reconsider its standard for bathing quality of river waters. Realistic, acceptable standards can only be developed by collecting data through organized research, including environmental and epidemiological parameters. (Baker-FRC)
W83-01320

RECENT INVESTIGATIONS ON THE EUTROPHICATION AND RESTORATION OF LAKE CONSTANCE (NEUERE UNTERSUCHUNGEN UBER DIE EUTROPHIERUNG UND SANIERUNG DES BODENSEES),
Konstanz Univ. (Germany, F. R.) Limnology Inst.
For primary bibliographic entry see Field 5G.
W83-01321

ACUTE FLUORIDE POISONING ASSOCIATED WITH AN ON-SITE FLUORIDATOR IN A VERMONT ELEMENTARY SCHOOL,
Vermont State Dept. of Health, Burlington.
R. L. Vogt, L. Witherell, D. LaRue, and D. N. Klaucke.
American Journal of Public Health, Vol 72, No 10, p 1168-1169, October, 1982. 1 Fig, 9 Ref.

Descriptors: *Public health, *Drinking water, *Fluoridation, Water pollution effects, Water pollution sources, Contamination, Human diseases, Water treatment, Vermont.

An outbreak of minor illnesses consisting of nausea and vomiting occurred on August 30, 1980 among individuals attending a farmers' market at a school in Vermont. A total of 22 persons were stricken. Illness was associated with the consumption of beverages made from school water. Analysis of the water indicated high levels of fluoride (1.041 mg/l). The most likely source of the contamination was the school fluoridator, which had accidentally been left on continuous operation. While the benefits of fluoridation for dental health are significant, public health officials are encouraged to lessen the possibilities of excess exposure by inspecting systems regularly and installing equipment which can protect against the consumption of high fluoride concentrations. (Baker-FRC)
W83-01329

A PILOT STUDY OF POTENTIAL PHENOLIC CONTAMINATION OF FISHES IN THE COLUMBIA RIVER AND TRIBUTARIES IN THE VICINITY OF MOUNT ST. HELENS,
Beak Consultants, Inc., Portland, OR.
K. P. Campbell, S. R. Johnson, and K. U. Wolniakowski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146357, Prices codes: A03 in paper copy, A01 in microfiche. Final Report, June 1982. 28 p, 1 Fig, 1 Tab, 14 Ref, 1 Append. OWRT-C-10072-V(1462)(1).

Descriptors: *Phenols, *Pentachlorophenol, *Fish, *Water pollution effects, *Volcanoes, *Mount St. Helens, Sediments, Salmon, Trout, Sturgeon, *Washington, Columbia River, Spirit Lake, Toutle River, Cowlitz River, Pollutant identification, Gas chromatography.

Following the eruption of Mount St. Helens on 18 May 1980, high levels of phenols were reported in water and sediments from Spirit Lake, the Toutle River, Cowlitz River and Columbia River. The potential for phenolic contamination in fish flesh from these waters was investigated by analysis of fish muscle samples. Analysis was by flame ionization detector gas chromatography on an extract of the muscle tissue. Confirmation of compound identity was by analysis of a pentafluorobenzyl derivative of the extract using the gas chromatography mated to an electron capture detector. Further confirmation of some samples was by gas chromatography/mass spectrometry. Water, sediment and soil samples were analyzed similarly. Phenol was found in three specimens: white sturgeon and coho salmon from the Columbia River, and sea-run cutthroat trout from the mouth of the Cowlitz River, with concentrations ranging from 26 to 56 ng/g. Pentachlorophenol was confirmed in 11 samples with concentrations ranging from 75 ng/g to 324 ng/g. These specimens consisted of eulachon from the Cowlitz River and salmonids from Deer Creek, a tributary of the North Fork Toutle River in the area affected by the mud flow. No pentachlorophenol was detected in water from either location. The presence of phenol at the levels reported is not a cause for concern. It is possible that the phenol originated either from industrial or natural sources. The reported levels of pentachlorophenol could potentially affect taste, but they are not a cause for concern relating to toxicity. (Moore-SRC)
W83-01354

ENVIRONMENTAL FACTORS PROMOTING AND REGULATING N2 FIXING BLUE-GREEN ALGAL BLOOMS IN THE CHOWAN RIVER, NC,
North Carolina Univ. at Morehead City. Inst. of Marine Sciences.
H. W. Paerl.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146381, Prices codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute of the University of North Carolina, Raleigh, Report No 176, January 1982. 74 p, 24 Fig, 9 Tab, 64 Ref. OWRT B-127-NC(4), 14-34-0001-0274.

Descriptors: *Eutrophication, *Cyanophyta, *Phosphorus, *Nitrogen, *Pulp wastes, *Color, *Salinity, *Water pollution effects, Diatoms, Chlorophyta, Seasonal variation, Orthophosphates, Dissolved oxygen, Industrial wastewater, Effluents, Photosynthesis, *North Carolina, Chowan River, *Nitrogen fixing bacteria.

Primary productivity, nitrogen fixation and the physical-chemical parameters regulating these processes, were examined in situ at a location in the lower Chowan River previously known to support blooms. During 1980 periods of weak thermal stratification, particularly during warming periods, coupled with phosphorus sufficiency, were crucial to nitrogen fixing blue-green algal bloom development. Phosphorus sufficiency could be established at relatively low ambient orthophosphate levels. Indirectly, nitrogen sufficiency was important as well. Spring diatom and green algal blooms relied heavily on nitrogenous nutrients (nitrate aand ammonia) for maximum development; the degree of spring bloom development was related to the potential for subsequent deoxygenation of river sediments and overlying water during warm, weakly stratified summer periods. Maximum deoxygenation was usually coupled with maximum blue-green algal bloom development. Pulp mill effluent, which was a highly significant water mass during the drought year 1981, showed negative effects on photosynthetic production, both through strong coloration of waters, thereby restricting transmission of photosynthetically active radiation, as well as chemically inhibiting growth. The chemical inhibition affected non blue-green algal growth more severely than blue-green algal growth. It appears that humic loading (due to pulp mill effluent) may potentially favor blue-green algal over more desirable diatom and green algal species, since blue-green algae can form surface scums and can counter growth inhibition due to humic chelation of essential trace metals. Salinity increases, observed during the drought of 1981, were strong deterrents to blue-green algal bloom formation during the summer months. (Moore-SRC)
W83-01357

THERMOPHILLIC AND THERMOTOLERANT FUNGI ISOLATED FROM THE THERMAL EFFLUENT OF NUCLEAR POWER GENERATING REACTORS: DISPERSAL OF HUMAN OPPORTUNISTIC AND VETERINARY PATHOGENIC FUNGI,
Chicago Univ., IL. Dept. of Medicine.
J. W. Rippon, R. Gerhold, and M. Heath.
Mycopathlogia, Vol 70, No 3, p 169-179, March, 1980. 1 Fig, 13 Tab, 22 Ref.

Descriptors: *Thermal pollution, *Fungi, *Nuclear powerplants, Powerplants, Heated water, Water pollution effects, Temperature effects.

Samples of water, foam, microbial mat, soil and air were obtained over a period of a year from areas associated with the cooling canal of a nuclear power station. The seventeen sample sites included water in the cooling canal that was thermally enriched and soil and water adjacent to, upstream, downstream and at a distance from the generator. Fifty-two species of thermotolerant and thermophilic fungi were isolated. Eleven of these are grouped as opportunistic Mucorales or opportunistic Aspergillus sp. One veterinary pathogen, Dactylaria gallopava, was also isolated. The opportunistic/pathogenic fungi were primarily found in the intake bay, the discharge bay and the cooling canal. Smaller numbers were obtained at both upstream and downstream locations. Soil samples near the cooling canal reflected enrichments of thermophilous organisms. Their numbers were greater than usual in a mesophilic environment. The findings suggest that there was no significant dissemination of thermophilous fungi from the thermal enrichment effluents to the adjacent environment. (Baker-FRC)
W83-01375

SHIFTS IN CADDISFLY SPECIES COMPOSITION IN SACRAMENTO RIVER INVERTEBRATE COMMUNITIES IN THE PRESENCE OF HEAVY METAL CONTAMINATION,
Institute of Paper Chemistry, Appleton, WI.
E. F. Zanella.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 3, p 306-312, September, 1982. 2 Fig, 3 Tab, 7 Ref.

Descriptors: *Caddisflies, *Heavy metals, *Species composition, Water pollution effects, Invertebrates, Sacramento River, *California, Metals, Zinc, Cadmium, Copper, Larvae, Brachycentrus, Hydropsyche, Toxicity.

Long-term monitoring (18 years) of caddisfly species in the Sacramento River, California, revealed a change in dominance from Brachycentrus americanus to Hydropsyche sp. beginning in 1972. By 1978 there were 900 Hydropsyche per sq ft and about 20 Brachcentrus per sq ft. The changes were related to increases in heavy metals during the monitoring period. Mean values from Cu and Zn in river water were higher in 1979 than in 1976. In 1980 caddisfly larvae contained more Cd, 4 times as much Zn, and less Cu than in 1976. Hydropsyche generally had higher metals levels than Bracyentrus. The changes in caddisfly larvae numbers were attributed to a difference in susceptibility to metals between the two invertebrates. (Cassar-FRC)
W83-01382

EFFECT OF SUSPENDED SEDIMENT ON FEEDING BY LARVAL HERRING (CLUPEA HARENGUS HARENGUS L.),
Department of Fisheries and Oceans, St. Andrews (New Brunswick).
D. D. Johnston, and D. J. Wildish.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 3, p 261-267, September, 1982. 4 Fig, 2 Tab, 7 Ref.

Descriptors: .*Suspended sediments, *Feeding rates, *Fish food organisms, Sediments, *Herring, *Larvae, Predation, Light intensity, Dredging, Growth stages, Water pollution effects.

Herring larvae were fed Artemia nauplii and wild zooplankton under various conditions of suspended sediment conditions (0, 4, 8, and 20 mg per liter) and light intensity (65, 105, and 300 lux). Significantly fewer food organisms were consumed at 20 mg per liter suspended sediments and at 65 and 105 lux than at the lower suspended sediment levels and control light intensity (300 lux). Smaller larvae consumed fewer Artemia in the presence of suspended sediments and decreased light intensity than the larger larvae. These findings, consistent with the hypothesis that suspended sediments inhibit feeding by interference with vision, suggest that dumping and dredging activities should be stopped during and immediately after spawning. (Cassar-FRC)
W83-01383

THE EFFECTS OF RECREATION ON FRESHWATER PLANTS AND ANIMALS: A REVIEW,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
M. J. Liddle, and H. R. A. Scorgie.
Biological Conservation, Vol 17, No 3, p 183-206, April, 1980. 9 Fig, 3 Tab, 61 Ref.

Descriptors: *Water pollution effects, *Recreation wastes, *Reviews, *Aquatic plants, *Aquatic animals, Environmental effects, Ecological effects, Boating, Camping, Fishing, Swimming, Hunting, *Great Britain.

The impacts of recreation on the freshwater plants and animals of Great Britain are reviewed. The effects of water-based recreation are caused mainly by boaters and include wash, turbulence, turbidity, propeller action, direct contact, disturbance to animals, and pollution from outboard motors and sewage. The effects of shore-based activities such as angling and swimming include trampling, sewage and other chemical impacts. Aquatic herbicides are often used to control weeds that interfere with water-based recreational activities. The release of chemicals from the painted hulls of boats, fishermen's bait and lead weights, the bodies of swimmers, and lead shot from the guns of hunters may also pose a threat to wildlife. The ability of recreation management to minimize some of these impacts is considered. Some recommendations for further research into the effects of recreational activities on freshwater animals and plants are discussed. (Geiger-FRC)
W83-01390

5D. Waste Treatment Processes

NEW AERATION SYSTEM CUTS WASTE TREATMENT COSTS AT BADGER PAPER,
Badger Paper Mills, Inc., Peshtigo, WI.
R. Kinzel, and J. Spellane.
Pulp and Paper, Vol 56, No 7, p 102-104, July, 1982. 3 Fig.

Descriptors: *Wastewater treatment, *Pulp and paper industry, *Aeration, Oxidation, Biochemical oxygen demand, Suspended soldis, Oxygen, Oxygen demand, Sludge, *Wisconsin.

The Badger Mills complex is an integrated 110-tpd, ammonium-base sulfite mill that uses furnish comprised of spruce, balsam, hemlock, and aspen. The mill's waste treatment plant is shared with the town of Peshtigo. Pulping generates an average monthly waste loading of 20000 lb/day of BOD, with a maximum rate of 40,000 lb/day. Some 95% of the load on the treatment plant is industrial; 5% is municipal. Treated waste can be discharged into the Peshtigo River with an allowable BOD of 2302 lb/day and a total suspended solids of 3530 lb/day, based on monthly average. A BOD of 600 lb/day and TSS of 1400 lb/day is typical of that actually discharged. The treatment plant is a gravity type continuous flow through system. Pulp mill waste and municipal waste are collected at a central metering station. Continuous overflow from the basins feeds three 80ft clarifiers operating in parallel. The sludge goes to a pumping station where part of the settled sludge is recycled to the head works and excess waste-activated sludge is sent to a 40-ft sludge thickener. Clarified effluent overflow passes to a chlorine chamber and is then discharged into the Peshtigo River. Thickened sludge is dewatered on a twin-wire filter press and transported to an on-site landfill area. Press filtrate is recycled to the head works. A new space and cost saving aeration system is described. The system is a single-stage BOD removal arrangement that results in capital and operating cost savings. In this system oxygen transfer takes place by molecular diffusion through the interface films between fine air bubbles and process liquor. (Baker-FRC)
W83-01062

CONTROL BY ALKALINE NEUTRALIZATION OF TRACE ELEMENTS IN ACIDIC COAL CLEANING WASTE LEACHATES,
Los Alamos National Lab., NM.
For primary bibliographic entry see Field 5G.
W83-01075

EQUILIBRIUM DISTRIBUTION COEFFICIENTS FOR EXTRACTION OF CHLORINATED HYDROCARBONS AND AROMATICS FROM WATER INTO UNDECANE,
California Univ., Berkeley. Dept. of Chemical Engineering.
T. A. Barbari, and C. J. King.
Environmental Science and Technology, Vol 16, No 9, p 624-627, 1982. 3 Tab, 7 Ref.

Descriptors: *Wastewater treatment, *Solvent extraction, *Organic compounds, Kerosene, *Undecane, Water pollution sources, Water quality control, Aromatic compounds, Hydrocarbons, *Chlorinated hydrocarbons.

Attempts were made to measure equilibrium distribution coefficients between undecane and water for a number or organic solutes contained on the priority pollutant list of the US EPA. Since undecane is a reasonable model of kerosene, the distribution coefficients are useful for evaluation of solvent extraction into kerosene. Solutes included chlorinated hydrocarbons, aromatics, bromoform, and 2-chlorophenol. Highly dilute solutions were

used, and analyses were carried out by flame ionization and electron-capture gas chromatography. The measured distribution coefficients were large enough to make extraction worthy of serious thought as a broad-brush process for removing such compounds from effluent waters. The measured distribution coefficients are also in line with reported solubilities in water. Distribution coefficients into undecane may be explained qualitatively in comparison with reported distribution coefficients into 1-octanol, through hydrogen-bonding concepts. (Baker-FRC)
W83-01076

DYNAMICS OF BIOFILM PROCESSES,
Nalco Chemical Co., Naperville, IL.
M. G. Trulear, and W. G. Characklis.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1288-1301, September, 1982. 21 Fig, 5 Tab, 36 Ref.

Descriptors: *Biomass, *Accumulation, *Films, *Biofilms, *Wastewater treatment, *Water treatment, Water distribution, Biological treatment, Microorganisms, Friction loss, Glucose, Kinetics, Cooling towers, Condensers, Energy loss, Fluid flow, Shear, Flow velocity, Mass transfer.

The effects of substrate loading and fluid velocity on biofilm accumulation were studied in a laboratory annular reactor. Although biofilms have a useful function in treatment of wastewater, drinking water, and streamwater, they cause energy losses, reduced efficiency, and decreased water quality in condensers, cooling towers, and water distribution systems. Nutrients and glucose were added to water in the reactor to promote biofilm growth. Material balance relationships were developed to analyze the processes contributing to biofilm formation. Rate expressions, dependent on reactor substrate concentrations, and biofilm mass, were described for rates of glucose removal, biofilm accumulation, and biofilm detachment. Biofilm accumulation was the difference between production (from metabolic growth) and detachment (from fluid shear). Glucose removal was directly proportional to the active biofilm thickness, corresponding to the depth of glucose penetration into the film. Increased glucose concentrations in the substrate increased the depth of glucose penetration. At low fluid velocities glucose removal was limited by the slow transfer of glucose from liquid to fluid-biofilm interface. The ratio and extent of biofilm accumulation increased with increasing glucose loading rate, increased with fluid velocity at low velocities, and decreased with increasing fluid velocity at high velocities. Biofilm detachment increased with fluid velocity and the mass of attached biofilm. Biofilm density increased with glucose loading rate. Low density biofilms were filamentous; high density biofilms were nonfilamentous, with dense patches of microbial colonies. Biofilm accumulations increased in proportion to biofilm thickness and with filamentous structure. (Cassar-FRC)
W83-01080

HIGH-DENSITY USE OF SEPTIC SYSTEMS, AVON LAKE, IOWA,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
K. Mancl, and C. Beer.
Proceedings, Iowa Academy of Science, Vol 89, No 1, p 1-6, 1982. 4 Fig, 3 Tab, 13 Ref. OWRT A-064-IA(2), 14-34-0001-7034.

Descriptors: *Septic tanks, Iowa, *Wastewater treatment, Well water, Nitrate, Longevity, *Iowa, Avon Lake.

Avon Lake, a rural-residential subdivision located southeast of Des Moines, has mostly summer cabins around a remnant gravel quarry. Surface material in the area is sand. Each of the homes has a shallow sand-point well for a water supply and a septic system for sewage treatment. Septic systems were examined for evidence of failure, house to house surveys were performed, and well water samples were taken. Fifty percent of the septic systems have been operating satisfactorily for more than 20 years. Only one of 68 well water samples contained fecal coliform bacteria. Thirty-six samples exceeded the nitrate standard, the highest being 25.6 mg/1 N. Nitrate concentration seemed to change in space but not with well age. Nitrogen loadings from cropland, septic systems, and animals were also estimated; they ranged from 40-120 lb/acre (45-135 kg/ha) for cropland, 35 1b/acre (15 kg/ha) for doga. All three of these could be important sources of nitrogen to the groundwater.
W83-01082

DYNAMIC SIMULATOR FOR ANAEROBIC DIGESTION PROCESSES,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Chemical and Environmental Engineering.
C. Kleinstreuer, and T. Poweigha.
Biotechnology and Bioengineering, Vol 24, No 9, p 1941-1951, September, 1982. 6 Fig, 1 Tab, 24 Ref.

Descriptors: *Anaerobic digestion, *Kinetics, *Organic wastes, *Wastewater treatment, Methane, Model studies, Simulation analysis, Digestion, Biomass, Manure.

An advanced dynamic model simulating the physical and biochemical phenomena of an anaerobic digestion process was developed. The two-culture model focuses on acetogenesis and methanogenesis, assuming that the complex waste has been hydrolyzed in a pretreatment step in a separate reactor. The model calculates the hydrolysis products of several common organic materials, accommodates various substrate feeding modes, and simulates the transient physico-biochemical transport and conversion processes occurring in all phases of a well-mixed reactor. A set of 11 coupled, nonlinear first-order rate equations was derived, based on the principles of mass conservation and biochemical reactor kinetics. Results from computer simulations fell into the range of published data. Biogas production, in particular carbon dioxide, was significantly affected by small changes in overall mass transfer coefficients for carbon dioxide, total N to carbonic species concentrations, and loading and discharge patterns. The process variables (gas flow rates, pH, and rate of volatile acid destruction) are sensitive to changes in substrate concentration, growth and decay parameters of the microorganisms, detention time, and amount of inhibitors present. (Cassar-FRC)
W83-01105

FLUIDIZED-BED FERMENTERS: A STEADY-STATE ANALYSIS,
State Univ. of New York at Buffalo. Dept. of Chemical Engineering.
G. F. Andrews.
Biotechnology and Bioengineering, Vol 24, No 9, p 2013-2030, September, 1982, 4 Fig, 1 Tab, 24 Ref.

Descriptors: *Fermentation, *Fluidized beds, *Films, Nitrogen removal, Nitrates, *Wastewater treatment, Model studies, Particle size, Biomass, Biological treatment, Tower fermenters, Supported-film fermenters, Stratification, Settling velocity, Kinetics.

A mathematical model is developed and used to design fluidized bed fermenters, both tower and supported-film types. This model overcomes some of the limitations of previous models for predicting effluent concentrations from fluidized bed fermenters. Biomass particle size need not be considered as an input parameter but is obtained as a consequence of the process by which the fermenter reaches a steady state. The effects of additional biomass on particle settling velocity are different in the two types of fermenters. In the tower fermenter, adding biomass increases the settling velocity; at steady state the bed is stratified and the cell concentration varies through the bed. In supported-film reactors biomass addition decreases the settling velocity; bed solids are completely mixed because all particles tend to have the same settling velocity in the steady state. Although the supported-film reactor's constant cell concentration is an advantage over the tower reactor's low cell concentration in the upper section, the supported-film process subjects the microorganisms to rapid changes in substrate concentration. Suggestions for better designs are: (1) a tapered tower fermenter which decreases the liquid velocity toward the top, and (2) a supported-film reactor containing variable-sized support particles to allow stratification to predominate over particle mixing. (Cassar-FRC)
W83-01106

ENVIRONMENTAL IMPROVEMENT ON NARRAGANSETT BAY AS A RESULT OF SECTION 312 IMPLEMENTATION OF THE FEDERAL WATER POLLUTION CONTROL ACT,
Rhode Island Univ., Kingston.
For primary bibliographic entry see Field 5G.
W83-01130

MASS TRANSFER IN A ROTATING BIOLOGICAL CONTRACTOR,
Exxon Research and Engineering Co., Florham Park, NJ.
W. K. Shieh.
Water Research, Vol 16, No 6, p 1071-1074, June, 1982. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Rotating biological contractor, *Mass transfer, *Dentrification, Nitrogen, Nitrates, Oxidation, *Biological wastewater treatment, *Wastewater treatment, Design criteria.

An attempt is made to determine the significance of mass transfer steps on the performance of a zero order rotating biological contractor (RBC). The approach commonly used for heterogeneous catalytic process analysis is used. To assess the mass transfer effects data collected from several RBC denitrification facilities are used. The following conclusions were reached. Substrate transport in the bulk liquid in a RBC is mainly induced by convection, and a constant substrate concentration exists in the bulk liquid. The observed reaction rate in a zero ordered RBC is first order if external mass transfer is rate-limiting. The observed reaction order changes from first order to half order when internal mass transfer becomes predominant. Denitrification RBC systems can be satisfactorily described by a half order kinetics. The effect of external mass transfer is insignificant in a RBC operated at a rotation speed of 7 rpm and a bulk liquid nitrate concentration of 0.9 mg nitrate-nitrogen/liter. The approach as offered in this report provides a rational basis for examining mass transfer effects in a RBC. (Baker-FRC)
W83-01198

ALPHA AND BETA FACTORS FOR DOMESTIC WASTEWATER,
Windsor Univ. (Ontario). Dept. of Civil Engineering.
P. K. Tewari, and J. K. Bewtra.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1281-1287, September, 1982. 2 Fig, 7 Tab, 17 Ref.

Descriptors: *Dissolved oxygen, *Oxygen uptake, *Alpha factor, *Beta factor, Aeration, *Wastewater treatment, Domestic wastewater, Laboratory studies.

Laboratory studies were conducted on wastewater and tap water samples to determine factors affecting the alpha factor (the ratio between rates of oxygen uptake in wastewater and tap water) and the beta factor (the ratio between dissolved oxygen saturation concentration in wastewater and tap water). Alpha values were not significantly affected by air flow rate (40-182 ml per min per liter), tank geometry (jar, basin, and rectangular basin), liquid depth (0.3-1.8 m), and aeration device, but they were dependent on wastewater characteristics. Addition of sodium sulfite (2.9-16.0 g) and cobalt chloride (1-4 mg) in various combinations to wastewater samples produced alpha factor values of 0.67-0.925. Beta factor values (average for all samples, 0.97) were not significantly affected by the above parameters. However, the dissolved oxygen saturation concentration increased with increases in water depth. It was more convenient to calculate the beta factor after correcting the dis-

solved oxygen saturation values for dissolved solids in samples. (Cassar-FRC)
W83-01207

CREATION AND OPERATION OF THE METROPOLITAN ST. LOUIS SEWER DISTRICT,
Metropolitan St. Louis Sewer District, MO.
C. B. Kaiser, Jr.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1247-1251, September, 1982. 1 Fig.

Descriptors: *Sewer systems, History, St. Louis, *Missouri, *Wastewater treatment.

The Metropolitan St. Louis (Missouri) Sewer District (MSD) was created in 1954 to centralize and coordinate wastewater collection and treatment in the region. Since the first sewers were built about the turn of the century, sewer construction had failed to keep pace with population growth. Many creeks were open sewers contaminated with untreated human and industrial wastes. The MSD, with a work force of 800 persons, is responsible for all wastewater and storm drainage facilities and treatment processes within the region. Within 5 years of the District's formation installation of sanitary sewer trunk lines had removed the disease threat in the streams. Sewer laterals and treatment plants were also built. In 1977 residents of the surrounding St. Louis county voted to be included in the MSD, adding 723 sq km to the 596 sq km area and 70 treatment systems, many of which were inadequate. Stormwater management projects are currently being defined for future implementation. (Cassar-FRC)
W83-01209

COMBINED SEWERS: MAINTAINING YESTERDAY'S INFRASTRUCTURE WITH TODAY'S TECHNOLOGY,
Metropolitan St. Louis Sewer District, MO.
J. F. Koeper, K. L. Coble, and J. Coll.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1252-1258, September, 1982. 4 Fig.

Descriptors: *Sewer systems, *Rehabilitation, Combined sewers, Grouting, St. louis, *Missouri, Inspection, Pipes, Linings, Wastewater collection.

A method for predicting potential failures in old, deteriorating combined sewer systems is being developed by the St. Louis (Missouri) Sewer District. The method under consideration assigns a priority ranking, based on risk potential and cost of damages, to a location. Some of the more important information levels would include: statistics on existing sewer routes (age, depth, size, type, etc), soil data, demographic data (to identify areas of high population density and real estate value), history of sewer failures, surface patterns visible from aerial photographs, and water main locations. St. Louis' old sewers have a variety of cross-sectional shapes: horseshoe, egg, and circular. Geological conditions contributing to sewer failures in this region are the alluvial deposits, numerous sinkholes in limestone bedrock, loess deposits, and flooding. Areas designated high risk by the computer analysis would be physically inspected, both visually, if possible, and by instrumental methods. Rehabilitation methods would be chosen according to the type of potential failure: shotcreting for strengthening sewers with large diameters, seal grouting to fill voids in surrounding soil, compaction grouting to compact surrounding soil, slipining for badly cracked or corroded pipes, steel plate lining to strengthen structural integrity, and in-situ forming to avoid extensive excavation. (Cassar-FRC)
W83-01211

SEEPAGE PONDS TO RECYCLE MUNICIPAL WASTEWATER,
South Dakota State Univ., Brookings. Dept. of Civil Engineering.
J. N. Dornbush.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139691, Price codes: A04 in paper copy, A01 in microfich. Completion Report, South Dakota Water Resources Research Institute, Brookings, July 1982. 49 p, 4 Fig, 6 Tab, 21 Ref, Append, OWRT A-073-SDAK(1), 14-34-0001-0144.

Descriptors: *Stabilization ponds, *Seepage, *Effluent seepage, *Nitrates, Ammonia, Phosphorus, Groundwater, Water pollution, *Groundwater pollution, *Municipal wastewater, *South Dakota, Wastewater treatment, Path of pollutant.

Four stabilization ponds in South Dakota were investigated to determine the long-term impacts of excessive pond seepage on groundwater quality. Emphasis was on nitrogen forms in the groundwater. The ponds had leaked excessively for more than 20 years and similar quality measurements had been made about 1970 for comparison. Seepage quality was measured at groundwater drains (titles and a ditch) and wells installed immediately outside the pond dikes. Chlorides and dissolved solids in the ponds were higher than in the native groundwater and groundwater in the vicinity of the pond may be slightly impaired for irrigation. Nitrate concentrations were acceptable in the groundwater near the ponds but nitrates were unacceptable at some control wells. Ammonia was removed to relatively low concentrations in the pond seepage although the efficiency of ammonia removal was substantially decreased with long-term continual seepage. Phosphorus was consistently removed to levels of 1 mg/1 or less. Limited data revealed that maximum contaminant levels for inorganic chemicals listed in drinking water standards were not being exceeded by the pond seepage.
W83-01238

THE SEPTIC TANK AS A WASTEWATER TREATMENT AND DISPOSAL FACILITY,
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
P. L. M. Veneman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139873, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, Kansas Water Resources Research Institute, Manhattan, September 1982, 22 p, 7 Fig, 4 Tab, 13 Ref. OWRT A-098-KAN(1), 14-34-0001-0118.

Descriptors: *Septic tanks, *Soil absorption capacity, *Leaching, Capillary conductivity, Permeability coefficient, Nonpoint pollution sources, *Wastewater treatment, Septic wastewater, Subsoil drainage, Subsoil, Soil Types, Water Repellent Soils, *Massachusetts, *Public Health Code, Public health standards.

Over 27% of the housing units in Massachusetts rely on the septic tank system for on-site wastewater disposal. The use of soils capable of absorption and renovation of septic tank effluent is essential for the successful disposal of home-generated sewage as the septic tank itself only provides rudimentary treatment. The contributions of the various components of the septic system are discussed on the basis of the available literature. Most soils in Massachusetts are unsuitable for wastewater disposal because of dense, relatively impervious layers in the subsoil, seasonally high groundwater tables, or overall compactness of the soil material. Massachusetts soils are rated for their suitability for on-site sewage disposal in terms of slight, moderate or severe limitations. Management practices to prevent or overcome these limitations are presented. Leaching area requirements are evaluated on the basis of in situ hydraulic conductivity measurements. Results indicate that the sizing criteria in the Massachusetts Health Code are conservative and have sufficient margins of safety to provide adequate treatment and safe disposal of waste waters.
W83-01241

EVALUATION OF DESALINATION TECHNOLOGY FOR WASTEWATER REUSE.
PRC Toups, Orange, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139899, Price codes: A17 in paper copy, A01 in microfiche. Office of Water Research and Technology Report OWRT/RU-82/8, August 1982. 385 p, 56 Fig, 126 Tab, 176 Ref. OWRT(7802), 14-34-001-7802.

Descriptors: *Wastewater treatment, *Desalination, *Reverse osmosis, *Evaporation, *Water reuse, *Electrodialysis, *Ion exchange, *Freezing, *Ultrafiltration, Wastewater renovation, Industrial wastewater, Municipal wastewater, Agricultural wastewater, Cost analysis.

As environmental constraints on wastewater discharge become more rigorous, desalting techniques are beginning to find application in effluent treatment processes. Applications of desalination technology to the treatment of municipal, industrial and agricultural wastewaters for reuse are beginning to occur. A survey of potential and wxisting applications of wastewaters using current desalination technology was conducted. The processes considered include reverse osmosis, electrodialysis, ion exchange, evaporation, freezing, and ultrafiltration. Standard Treatment Systems for desalination of wastewater have been developed to enable potential users to identify process requirements and costs for specific wastewaters. Industrial, agricultural and municipal wastewater desalination and reuse is technically possible. The relatively high capital, operational and maintenance costs of desalination processes are the primary deterrents to widespread application. However, as wastewater discharge limitations become increasingly restrictive, desalination processes may be economically competitive. Industry is the largest potential user of wastewater desalination and reuse systems. The potential for potable reuse of any wastewater is relatively low due to potentially adverse health effects. Non-potable reuse of municipal wastewaters has average potential in areas with costly or limited water supplies. Industry could use both municipal and agricultural wastewaters in areas with expensive or limited water supplies. The reuse of wastewater for agriculture would greatly increase the costs of food crops. (Moore-SRC)
W83-01270

PRESENCE OF ENTERIC MICROORGANISMS IN THE AIR ENVIRONMENT AT WASTEWATER TREATMENT PLANTS IN PUERTO RICO,
Puerto Rico Univ. Mayaguez. School of Engineering.
M. A. Padovani.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139915, Price codes: A03 in paper copy, A01 in microfiche. Report, December 1981. 25 p, 3 Tab, 19 Ref. OWRT A-070-PR(2).

Descriptors: *Public health, *Wastewater treatment plants, *Aerosols, *Air pollution, *Coliforms, *Puerto Rico, Enteric bacteria, Trickling filters, Activated sludge process.

In Puerto Rico there is a growing concern about the incidence of diarrhea and other enteric diseases. As an overpopulated island, there is almost no uninhabited region and large amounts of wastewater are generated. As wastewater treatment plants are located near population centers, and as most areas around them are under the action of treatment plant aerosols, a study was undertaken to determine the presence of coliforms of potential health hazard in the vicinity of the plants. The air environment around two trickling filter and two activated sludge wastewater treatment plants was investigated, using impingers of direct exposure of agar plates. The trickling filter plants did not show the production of any aerosolized coliform bacteria that could be detected at a distance of 30.5 m. In the activated sludge plants coliform and fecal coliform bacteria were detected 20.5 m downwind, even though their number was not great. As all samples were taken during daylight hours when solar radiation was at its peak, the temperatures were high, and wind velocity was not high, these test conditions are possibly responsible for the low coliform counts obtained. Both the trickling filter and the activated sludge types of wastewater treatment plants do not seem to be a public health risk as they are effective in reducing the number of coliforms of fecal origin from the aerosols produced by them. (Moore-SRC)
W83-01272

WEAK-ELECTROLYTE ION EXCHANGE IN ADVANCED-TECHNOLOGY WATER-REUSE SYSTEMS,

California Univ., Berkeley. Water Thermal and Chemical Technology Center.
G. Klein, J. Sinkovic, and T. Vermeulen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139972, Price codes: A05 in paper copy, A01 in microfiche. Office of Water Research and Technology Report OWRT/RU-82/7, February 1982. 94 p, 35 Fig, 6 Tab, 24 Ref, 3 Append. OWRT C-80300-R(8809)(1), OWRT C-90063-R(9418)(1). 14-34-0001-8809, 14-34-0001-9418.

Descriptors: *Ion exchange, *Resins, *Wastewater treatment, *Phosphates, *Water reuse, Wastewater renovation, Phosphorus removal, Equilibrium, Salinity, Effluents.

Ion-exchange treatment can be used to purify wastewater in various ways, including selective removal of individual unwanted ionic species. Weak-acid and weak-base ion exchangers, relatively new on a commercial scale, furnish and exceptional range of performance capabilities with the prospect of unusually efficient and inexpensive regeneration. Column runs, as well as batch experiments, established the equilibrium data fit the Law of Mass Action, with activity coefficients correcting satisfactorily for nonidealities in both solution and resin phase. Behavior of weak-electrolyte resins is more complex than for strong electrolytes. This produces fairly large nonidealities in dilation behavior and Donnan uptake, and probably also in intraparticle diffusion rates. Phosphate was used as a model impurity in this study, and a secondary municipal effluent high in phosphate was modeled. A combination of general salinity reduction with impurity removal increases the useability of product water. Nearly complete acidification gives the best results for phosphate uptake. A new technique, segmented-bed operation, has been developed to minimize the cost and use of regenerant chemicals, and the disposal of regeneration wastes. By this technique, a major interfering species can be soted on an ion-exchange column, preparing the way for effective removal of the impurity in a separate bed. The sorted species is then returned to the product water by a reversal of the original exchange process. (Moore-SRC)
W83-01275

SORPTION OF PHENOL BY CHEMICALLY TREATED FLYASH,
Sri Venkateswara Univ., Tirupati (India). Coll. of Engineering.
G. Ramprasad, and B. Kotaiah.
Journal of the Institution of Engineers (India), Part EN, Environmental Engineering, Division, Vol 62, No 2, p 56-58, February, 1982. 3 Fig, 2 Tab, 6 Ref.

Descriptors: *Wastewater treatment, *Sorption, *Flyash, *Phenols, Organic compounds, Industrial wastes, India.

A study was made to evaluate the mechanism and sorption capacity of acid treated flyash and to find the effect of weight of flyash sample on the sorption of phenol at constant pH and temperature. The sorption of phenol by chemically treated flyash at pH 4.6 and at a temperature of 28C was found to be sensitive to the weight of flyash in the range of 1-20 g/1. However, there is no significant difference in phenol sorption for 1 and 2 g/1 of flyash. When sorption data is plotted according to the Langmuir equation, a non-linear isotherm is observed at the lkower phenol oncentration for the 20 g/1 of flyash treatment. The sorption maximum value and the constant related to the bonding energy of the sorbate to the sorbent computed for 2 g/1 of flyash are 1.175 mg phenol/g and 0.03415 1/g, respectively. Sorption capacity of flyash per unit weight decreases with increasing initial flyash concentration. The sorption of chemically treated flyash is 16 times more efficient that of the untreated flyash. (Baker-FRC)
W83-01296

SRT TECHNIQUE IN WASTEWATER PROCESS DESIGN,
Polytechnic Inst. of New York, Brooklyn.
R. S. Gupta.
Journal of the Institution of Engineers (India), Part EN, Environmental Engineering Division, Vol 62, No 2, p 68-72, February, 1982. 5 Fig, 1 Tab, 12 Ref.

Descriptors: *Wastewater treatment, *Design criteria, *Biological wastewater treatment, Kinetics, Microorganisms, Biochemical oxygen demand, Oxygen demand, Bacteria, *Solid retention time.

The SRT (solid retention time) technique is based on the kinetics of the microbial growth and the law of conservation of mass. The basic kinetic relations have been developed in a sequence. A simple biological system has been considered to derive the fundamental expression of the SRT relationship. The design parameters, which are manipulations of the kinetic relations and the fundamental equation, have been summarized for three models. The step-by-step procedure for the process design has been described that enables an engineer to design a system. SRT is a function of cell wastage rate and organisms concentration, both being characteristics which are easy to determine. The microbial grown kinetics and mass balance equations with certain assumptions form the basis of simple relations between SRT and various design parameters. The SRT Design Technique, as such, provides a very convenient and simple method of biological treatment process designs. (Baker-FRC)
W83-01297

WATER HYACINTH FOR TREATING DAIRY WASTE,
Delhi Coll. of Engineering (India).
A. F. S. A. Aowal, and J. Singh.
Journal of the Institution of Engineers (India). Part EN, Environmental Engineering Division, Vol 62, No 2, p 73-75, February, 1982. 6 Fig, 2 Tab, 10 Ref.

Descriptors: *Wastewater treatment, *Industrial wastes, *Aquatic plants, Water hyacinth, Biodegradation, Dairy industry, India.

Vascular plants hold considerable promise in the treatment of industrial waste as a cheap method of disposal. The water hyacinth is one such plant. The characteristic changes brought about if water hyacinth is grown in dairy wastes were noted so as to evaluate its potential as a method of treatment for the disposal of organic wastes of similar nature. It was observed that water hyacinth enhanced biodegradation, lowered pH, and in four days BOD was reduced by 60%, COD by 50%, and total solids by 25%. The removal of oil and grease was observed to be 80% in 10 days. These findings were compared with controls without water hyacinth. The results indicate that water hyacinth growth can be used as primary treatment method for reducing BOD, pH, and suspended and total solids for small dairy plant effluents. (Baker-FRC)
W83-01298

TREATMENT OF DAIRY WASTE BY FLOCCULATING ALGAEL BACTERIAL SYSTEM,
Delhi Coll. of Engineering (India).
A. F. S. A. Aowal, and A. K. Agarwal.
Journal of the Institution of Engineers (India), Part EN, Environmental Engineering Division, Vol 62, No 2, p 76-79, February, 1982. 6 Fig, 3 Tab, 10 Ref.

Descriptors: *Wastewater treatment, *Dairy industry, *Flocculation, *Algae, *Bacteria, Biochemical oxygen demand, Chemical demand, Oxidation, Industrial wastes, Aeration, Activated sludge process, Oxidation ponds.

A comparative evaluation of a new technique using the algal-bacterial flocculation system for the treatment of dairy waste is presented. A laboratory study of the algal-bacterial system is compared with the activated sludge system, an oxidation pond system and a simple aeration system. It has been noted, after running all the above processes for 16 days in the laboratory, that while the algal-bacterial system removed about 93% of BOD and 96% COD, the activated sludge system removed only about 90% BOD and 91% COD, the oxidation pond system 51% BOD and 75% COD and the simple aeration system 60% BOD and 64% COD. The performance evaluation of different algal-bacterial ratios showed that 1000 mg/1 ofalgal concentration gave the best performance. Four day run of this system seemed to give the best results when compared with the other systems run under the same set of conditions. (Baker-FRC)
W83-01299

REMOVAL OF COLOUR IN TERTIARY TREATMENT OF SANITARY SEWAGE BY CHEMICAL METHODS,
National Environmental Engineering Research Inst., Nagpur (India).
S. R. Kshirsagar, D. S. Joshi, and T. A. Sihorwala.
Journal of the Institution of Engineers (India), Part EN, Environmental Engineering Division, Vol 62, No 2, p 80-83, February, 1982. 3 Fig, 4 Tab, 5 Ref.

Descriptors: Wastewater treatment, *Color removal, *Alum, Chemical reactions, Hazen's units, Textile industry, Dye wastewater, Tertiary wastewater treatment, Wastewater, Industrial wastewater, Lime slurry, Hydrose, Polyelectrolyte.

The results of a study on the removal of color from the secondary treated effluent of an activated sludge treatment plant are presented. For the removal of color different chemicals were used. These include alum, lime slurry, hydrose and liquid polyelectrolyte. From the average characteristic of secondary treated sewage it was clear that for the use of any coagulant, adjustment to alkaline range was relatively easy and economical. Using liquid polyelectrolyte it was noted that the optimum dose of polyelectrolyte for color removal is on the order of 40 0 mg/l which reduced color from 60 to about 5 Hazen's at pH 7.8. Using alum as coagulant took doses between 50 to 70 mg/l with initial color value in the range 40 to 60 Hazen's units. With lime treatment, the increase in dose of lime at pH 11.0 caused improvement in the removal of color rapidly in the beginning but beyond a dose of 250 mg/l the removal was insignificant. This dose reduced the color by 61.9% from its original value of 55 Hazen's units. A dose of 50 mg/l sodium hydrose at pH 7.2 gave color removal to 5.0 from the original 50.0 Hazen's units. The alum treatment worked economically for the desired removal of color. (Baker-FRC)
W83-01300

OPTIMIZED ENERGY EXPLOITATION THROUGH AEROBIC-ANAEROBIC TWO-PHASE STABILIZATION (OPTIMIERTE ENERGIEAUSNUTZUNG DURCH DIE AEROB-ANAEROB ZWEIPHASEN-STABILISATION),
Ingenieur-Buro Unger, Damstadt (Germany, F.R.).
G. Riegler.
Gas- und Wasserfach: Wasser/Abwasser, Vol 123, No 6, p 296-302, 1982. 8 Fig, 16 Ref. English summary.

Descriptors: *Sludge digestion, *Energy, *Wastewater treatment, *Aerobic digestion, *Anaerobic digestion, Biological treatment, Heating, Temperature, Seasonal variation, Methane, Hydrogen ion concentration, Aeration.

The heating of raw sludge to digestion temperature presents the greatest negative factor in the energy balance of anaerobic reactors for sewage sludge stabilization. The suggestion that an air-aerated, self-heating aerobic digestion procedure could effectively be used for this purpose was investigated. A two-and-one-half month long experimental series using two-phase stabilization with an aerobic-thermophilic first stage and an anaerobic-thermophilic second stage (each at 50 C) revealed this system to be effective. Self heating of sludge with aerobic stabilization in isolated tanks can only occur above a certain start temperature that is lower in summer than in winter. If the tank is set up to achieve the greatest possible self heating with the samllest possible substrate degradation, holding times in winter of under three days without external heating sources will not produce stable operating conditions, while in summer holding times of two days will result in self heating. With holding times of 5-10 days, operating temperatures of > 40 C are to be expected all year; above 20 C self heating will always occur. The experiments showed that preliminary aerobic-ther-

mophilic treatment with a short holding time produced degraded sludge that can immediately be stabilized further by anaerobic processes. While the aerobic predigestion reduces possible methane gas development in the next digestion tank, it does contribute to raw-sludge heating (about 20 C with a degradeable COD reduction of about 33% and a 3-day holding time). The aerobic first stage increases pH of raw sludge out of the acid to at least the neutral area, reducing the danger of low pH in the digestion tank. The first stage can reduce volume and concentration fluctuations to improve load distribution in the digestion tank. Further research is necessary to investigate the influences of aerobic predigestion, aerobic-anaerobic environment change, and temperature on metabolic processes in the anaerobic stage and on the stability and quality of the treated sludge. (Gish-FRC)
W83-01304

PRECIPITATION TREATMENT OF MUNICIPAL WASTEWATER WITH ADDED ACTIVATED CARBON (FALLUNGSREINIGUNG VON KOMMUNALEM ABWASSER MIT ZUSATZ VON AKTIVKOHLE),
Hoechst A.G., Huerth/Knapsack (Germany, F. R.).
D. Gleisberg.
Gas- und Wasserfach: Wasser/Abwasser, Vol. 123, No. 6, p 308-313, 1982. 5 Fig, 8 Tab, 10 Ref. English summary.

Descriptors: *Precipitation treatment, *Activated carbon, *Wastewater treatment, *Municipal wastewater, *Combined treatment, Costs, Aluminum, Iron, Phosphorus removal, Phosphates, Zinc, Copper, Heavy metals, Organic compounds, Chemical oxygen demand, Total organic carbon, Dissolved solids, Biological treatment.

A combined procedure of treatment with activated carbon (AC) and precipitating agents was used for municipal wastewater in order to reduce the cost of treatment with AC alone. The results of comparisons between successive and simultaneous treatment of secondary-treatment-basin (STB) water revealed lower total organic carbon (TOC) levels for simultaneous treatment with all precipitating agents. TOC elimination with the combined procedure approached the sum of elimination with the two separate methods, indicating that the treatment media possess different areas of effect and complement each other to advantage. The three agents used, aluminum and iron (Fe(II) and Fe(III)) salts, were similarly useful. The laboratory AC treatment time of 10 min was considered very short, resulting in the reduction of residual COD giving only a shallow curve over time; a rate at least twice as high could be expected in a working wastewater treatment plant. This phenomenon was also reflected in the shallow curve drawn when COD elimination was plotted against AC concentration. Additional precipitation treatment further reduced COD from about 40 to 20 mg/l in STB water and from about 200 to 150 mg/l in primary-treatment-basin water (PTB). Phosphate was successfully removed, indicating good phase separation, as precipitation removes phosphates but AC does not. Both precipitation and AC removed zinc and copper, between one- and two-thirds of zinc being eliminated. With 200 mg/l precipitating agent and 50 mg/l AC, a COD removal rate of 30-50% (maximum 70%) was achieved; similar results were attained for TOC with 100 mg/l AC and 200 mg/l precipitating agents. Both treatments reduced dissolved organic carbon. The physical/chemical treatment of PTB water is only useful for one-stage plants with unsatisfactory treatment results. The results of this investigation should encourage the use of the combined treatment in activated sludge plants. Highly polluted turbulent water resulting from anaerobic sludge digestion may also be so treated. (Gish-FRC)
W83-01307

LOW COST TECHNOLOGY FOR DISPOSAL OF HUMAN EXCRETA WITH COMMUNITY LATRINES,
UP Jal Nigam, Lucknow (India).
G. Sagar.
Journal of the Institution of Engineers (India), Part EN, Environmental Engineering Division, Vol. 62, No. 2, p 47-50, February, 1982. 3 Fig, 2 Tab, 2 Ref.

Descriptors: *Sewer systems, *Design criteria, Soak pits, *India, Wastewater disposal, Latrines.

Attention is focused on design aspects of a new system of latrines in non-sewered areas. By adopting the new design not only is the initial cost reduced, but subsequent maintenance becomes much easier. The first step to improve the community latrine system called for improved design of the septic tank, with tank capacities being worked out for 10 to 100 and 150 to 500 users. Wall thicknesses of 11.4 cm and 23 cm respectively are recommended for the two tank capacities. Structural design considerations indicate that a circular shape is preferred to a rectangular and for reasons of economy. The effluent can be disposed of into soak pits, or it can be discharged into an open drain in areas where drainage systems exist. An improved soak pit design comprises cinder and various sizes of brick ballast or burnt coal, topped with a distribution slab, earth filling and grass layer. The cost of the improved system is significantly reduced. The costs of sanitary fittings are reduced to a minimum, as is the cost of the septic tank. (Baker-FRC)
W83-01319

NITROGEN REMOVAL WITH ROTATING DISC SYSTEM (STICKSTOFFELIMINATION MIT DEM TAUCHTROPFKORPER),
Feng Chia Coll. of Engineering and Business, Taichung (Taiwan).
P-S. Cheung.
Wasserwirtschaft, Vol. 72, No. 6, p 235-239, 1982. 12 Fig, 2 Tab, 5 Ref. English summary.

Descriptors: *Nitrogen removal, *Rotating disc system, *Nitrification, *Denitrification, *Wastewater treatment, Temperature, Sludge age, Biological oxygen demand, Sludge excess, Methanol, Industral wastewater, Municipal wastewater, Water treatment.

A rotating disc system (RDS) was used to investigate the efficacy of nitrification and denitrification for nitrogen removal in the treatment of drinking water. With a 5-day BOD disc load of < 5 g/sq m per day, an NH4(+)-N reduction of $> 90\%$ was achieved, while with higher disc loads the reduction quickly diminished. Successful nitrification and 5-day BOD reducxtion will occur with a two-cascade RDS under disc loads of 4.5 g/sq m per day for 5-day BOD and 2.5 g/sq m per day for NH4(+)-N. However, a four-cascade RDS is recommended, and this can tolerate higher loads. The influence of flow-through time is negligible compared with that of 5-day BOD disc load, and within the range of 5-22 C temperature influence is also insifnificant. Acid capacity was reduced by nitrification, but not to the extent that it hampered the process, With low 5-day BOD disc load (< 5 g/sq m per day), sludge age was high (> 5 days), and thus nitrification was successful. An excess slude production of 0.4 kg/kg 5-day BOD degradation occurred with nitrification. Nitrogen removal can be achieved through the addition of methanol in the denitrification stage for industrial wastewaters containing nitrate in the absence of other carbon compounds. For municipal wastewaters,. a RDS with low loads and preliminary denitrification stage is recommended for nitrogen elimination. Over 60% nitrogen removal with 200% feedback of raw wastewater as an electron donor is technically feasible. (Gish-FRC)
W83-01323

NITROGEN REMOVAL BY MEANS OF PRELIMINARY DENITRIFICATION (STICKSTOFFELIMINATION DURCH VORGESCHALTETE DENITRIFIKATION),
Stuttgart Univ. (Germany, F.R.). Inst. fuer Siedlungwasserbau, Wassergute- und Abfallwirtschaft.
K. Krauth, and K. F. Staab.
Wasserwirtschaft, Vol 72, No 6, p 251-252, 1982. 1 Fig, 5 Tab, 1 Ref. (No English Summary).

Descriptors: *Nitrogen removal, *Denitrification, *Activated sludge process, Municipal wastewater, *Wastewater treatment, Federal Republic of Germany, Biological wastewater treatment, Oxygen, Ammonium, Organic compounds, Weather.

An activated sludge wastewater treatment plant with aerobic stabilization in Biet (Federal Republic of Germany) was used to test the efficiency of nitrogen removal by means of preliminary denitrification. The activated sludge basin used was intended for 7,000 population equivalents with a dry-weather inflow of 104.5 cu m/hr (24-hr mean, 92.0 cu m/hr). The secondary clarification basin had a capacity of 185.0 cu m/hr of rainwater and was provided with this amount during the experiment. The experiment showed that the oxidation of ammonium nitrogen to nitrites and nitrates was dependent on the oxygen concentration in the nitrification basin. The minimal daily oxygen concentration was the deciding value as long as it did not last more than one hour. In the latter case, some concentration of NH4(+)-N was to be expected in the effluent. NH4(+)-N effluent concentrations approaching zero can only be expected with a minimum oxygen concentration in the nitrification basin of 0.5 mg/l. Organic nitrogen concentrations of 1.34-7.70 mg/l were found in the plant effluent despite the fact that ammonium content was near zero. When the denitrified nitrogen values were related to the solids content in the denitrification stage, the resulting total denitrification rate ranged from 0.0129 to 0.0576 kg/(kg x day), with noticeable differences occurring between wet and dry weather. The success quotient H, resulting from the relationship between the actually denitrified nitrogen volume and the theoretically denitrifiable nitrogen volume (taking recirculation into account), ranged from 61.7% to 89.9% (total and was lower in wet (53.8-75.8%) than in dry (79.2-96.9%) weather. (Gish-FRC)
W83-01324

CAUSES, PREVENTION AND CONTROL OF BULKING SLUDGE IN ACTIVATED SLUDGE PLANTS (URSACHEN, VERHINDERUNG UND BEKAMPFUNG DER BLAHSCHLAMMBILDUNG IN BELEBUNGSANLAGEN),
Wehrle-Werke A.G., Emmendingen (Germany, F.R.).
F. Wagner.
Wasserwirtschaft, Vol 72, No 6, p 229-234, 1982. 8 Fig, 1 Tab, 11 Ref. English summary.

Descriptors: *Bulking sludge, *Activated sludge, *Wastewater treatment, *Filamentous microorganisms, *Phosphorus, Nitrogen, Denitrification, Biological oxygen demand, Heat loss, Calcium, Iron compounds, Sludge index.

In more than half of all activated sludge plants the desired degree of purification is not attained, due in many cases to inadequate separation of the activated sludge from the treated water. This is often associated with the development of filamentous microorganisms, which promote the formation of bulking sludge. Bulking sludge is defined as activated sludge with a sludge index (SI) of > 150 mg/g. The results of chemical and physical analysis of 150 activated-sludge samples from 150 treatment plants revealed that in municipal plants the filamentous bacteria Type 021 N, Microthrix parvicella and Type 0041 together form about 50% of bulking sludges. Plants with preliminary treatment produced sludges with the highest SI: in about 70% of these plants an SI of 150 ml/g was exceeded in two months of the year. The SI was positively related to the 5-day BOD volume load, with a maximum SI occurring with loads of 0.4-0.7 kg/(cu m per day) in these plants. Sludges with a heat loss of $> 70\%$ were not easily separated. SI and phosphorus/nitrogen ratio were positively related. Two hypotheses for the cause of bulking sludge formation are discussed. The surface-volume hypothesis postulates that filamentous organisms, because of their large surface area, have a selective advantage over floc-forming bacteria when a large amount of dissolved substrate exists in wastewater. The phosphorus/nitrogen hypothesis suggests that low phosphorus levels are responsible for bulking sludge formation. This hypothesis was confirmed in an experiment using the phosphorus/heat loss ratio in place of the phosphorus/nitrogen ratio. Denitrification can therefore aid in the prevention

of bulking sludge formation. Methods to control the problem include the addition of iron salts into activated-sludge circulation, the use of calcium in the inflow to the secondary treatment basin, and the substitution of Thomas phosphate for phoshoric acid in wastewaters low in phosphates. (Gish-FRC)
W83-01325

EXPERIENCE REPORT FOR DECENTRALIZED WASTEWATER TREATMENT (ERFAHRUNGSBERICHT MIT DER DEZENTRALEN ABWASSERREINIGUNG),
Peter Scholz Ing. G.m.b.H., Kirchberg/Jagst (Germany, F.R.).
R. Pfeiffer.
Wasserwirtschaft, Vol 72, No 6, p 250-251, 1982. 1 Fig. (No English Summary).

Descriptors: *Wastewater facilities, *Costs, *Biological oxygen demand, *Municipal wastewater, Hoval Compact Wastewater Treatment Facility, Biological wastewater treatment, Phosphorus removal, Rotating disc system, Precipitation treatment, Federal Republic of Germany.

The Hoval Compact Wastewater Treatment Facility has been in use in the Federal Republic of Germany since 1976. It is designed to provide advanced wastewater treatment including phosphate removal for population equivalents of 100-3,000. The three-stage process consists of primary mechanical treatment, biological treatment, and chemical precipitation with secondary treatment. It has been proven that the rotating disc system in combination with other processes works well for small communities. The special advantage of this system is its favorable relationship between energy requirement and purification level as well as its insensitivity to load fluctuations. A significant increase in efficiency of the mechanical stage is achieved by recirculation into the sedimentation basin after the biological stage. In the third stage the precipitating agent is added to the multi-chamber flocculation tank proportional to the volume of water to be treated to reduce costs. To investigate the efficacy of this process, measurements of 5-day BOD, COD and methylene blue active substances were made at 14 plants over 286 days. The legal limit of 25 mg/l 5-day BOD in inflow was not exceeded. Plant stability was extremely high and corresponded to that of fully biological plants with low loads. Five-day BOD levels of 20 mg/l could be maintained even with excessive loads, and in general a total phosphate level of $<$ 1 mg/l could be achieved. Hydraulic peaks in the biological stage are avoided by using intermediate buffers in the primary stage; this also allows an absence of hydraulic overload in the third stage. (Gish-FRC)
W83-01326

FIRST OPERATIONAL EXPERIENCE AT THE WASTEWATER TREATMENT FACILITY OF THE BREISGAUER BUCHT WASTEWATER ASSOCIATION (ERSTE BETRIEBSERFAHRUNGEN AUF DER KLARANLAGE DES ABWASSERZWECKVERBANDES BREISGAUER BUCHT),
G. Heinz.
Wasserwirtschaft, Vol 72, No 6, p 253-255, 1982. 3 Fig, 2 Tab. (No English Summary).

Descriptors: *Wastewater facilities, *Biological oxygen demand, *Nitrification, *Activated sludge process, Carbon dioxide, Hydrogen ion concentration, *Federal Republic of Germany, Breisgauer Bucht wastewater treatment facility, *Wastewater treatment, Biological treatment, Costs.

The first report of operation of the Breisgauer Bucht (Federal Republic of Germany) mechanical-biological wastewater treatment facility is presented. The facility was built to serve an area of about 500 sq km with 600,000 population equivalents (PE). In 1980 about 27 h cu m and in 1981 about 45 h cu m of water were treated, and in 1981 the dry weather inflow was about 100,000 cu m/day. The plan for available storage space in the inflow and bypass channels to be used in rainy weather was successful, as evidenced by the fact that in only three cases did combined water overflow into the receiving stream. Minor problems encountered during the pilot run and early operation were easily corrected. Daily 5-day BOD levels were 7.5-46.5 and 3.2-36.3 metric tons in the inflows to the plant and biological stage, respectively; levels in effluent ranged from $<$ 3 to 86 (mean, 17). Undissolved substances and settleable substance were found in the effluent in concentrations of $<$ 10 and $<$ 0.1 mg/l, respectively. Aeration times ranged from 2.5 to 5.7 hours. The operation of the activated sludge plant with oxygen gasification was very stable. The various processes hardly affected effluent 5-day BOD or COD, though they did produce fluctuations in the differences between 5-day BOD as determined by the presence or absence of nitrification inhibitors. Little nitrification occurred with two activated sludge basins and a dry matter loading $<$ 0.2. With three basins and a dry matter loading $=$ 0.16, the nitrification rate was about 35%. The highest rate was $>$ 80% in October and November at a dry matter loading of 0.12. With sludge loads of $=$ or $>$ 0.16 the carbon dioxide level was $<$ 18 mg/l, but with dry matter loading $=$ 0.12, the average level was 38 mg/l. With sludge-load reduction, pH value also declined. (Gish-FRC)
W83-01327

COSTS OF PREVENTIVE MAINTENANCE PROGRAMS IN WASTEWATER COLLECTION SYSTEMS,
Burns and Roe Industrial Services Corp., Paramus, NJ.
J. Liebesking, and J. LaFond.
Public Works, Vol 113, No 9, p 82-84, September, 1982. 1 Fig, 5 Tab, 5 Ref.

Descriptors: *Costs, *Wastewater collection, *Maintenance costs, Capital costs, Estimated costs, Operating costs, Total costs, Wages, Personnel, Sewer systems.

Estimates of average annual costs for providing preventive and corrective maintenance programs are given for wastewater collection systems serving population sizes of 10,000 to 1 million. Total costs (in 1980 dollars), not including major reconstruction or new construction, are $167,000-$12,033,000. Personnel costs, $62,000-$4,850,000, are listed according to occupational title, annual salary, and number of each type of employee. Operating costs are assumed equal to personnel costs. Equipment needs are $20,000-$586,000. Administrative costs, $23,000-$1,765,000, are assumed at 18% of operating and maintenance costs. A formula is given to adjust for differences in local costs and inflation. (Cassar-FRC)
W83-01339

FRITO-LAY TURNS WASTE INTO PROFIT.
Food Engineering, Vol 54, No 9, p 102-104, 106, September, 1982. 1 Fig, 1 Tab.

Descriptors: *Wastewater treatment, *Food processing industry, *Design criteria, Industrial wastes, Advanced wastewater treatment, Wastewater facilities, Treatment plants, Frito-Lay, Frankfort, *Indiana, Industrial plants.

Frito-Lay Corporation included in its planning of a huge snack food plant in Frankfort, Indiana, its own waste treatment system rather than pay for inclusion in the municipal system already there. As a result the company expects to generate $60,000 to $80,000 per year in sales of wastewater byproducts. The system also avoids sludge removal costs in excess of $100,000 per year. A unique heat recovery system and energy related improvements in the process line allow the plant to save an estimated 400,000 gallons per year in fuel oil and $300,000 per year in energy costs. Through energy efficient pollution control measures an additional $126,000 per year is estimated to be saved. The on-site wastewater treatment consists of primary and secondary treatment of process wastewater, plus on-site tertiary treatment prior to discharge into Wildcat Creek. Process wastewater comes from potato wastewater from washing; and oil and grease wastewater from cleaning of processing equipment. (Baker-FRC)
W83-01351

PROCESS DESIGN OF ANAEROBIC SLUDGE DIGESTION,
Severn-Trent Water Authority, Birmingham (England).
G. P. Noone.
Effluent and Water Treatment Journal, Vol 22, No 5, p 193-194, 196-197, May, 1982. 5 Fig, 1 Tab, 20 Ref.

Descriptors: *Sludge digestion, *Design criteria, Anaerobic conditions, Sludge, *Wastewater treatment.

Relevant areas for considertion in the process design of anaerobic Sludge digestion programs are considered. Absolute design values are not available in many important areas, although work to remedy this is underway in many cases. Any meaningful use of the detention time parameter requires a fully utilized reactor volume, since any ineffective reactor volume reduces the nominal detention time. Solids level is the other important processing input determining reactor volume. Extreme loadings have been cited as causing process failure at very low detention periods. The majority of inherited digestion systems seem to have been provided on some variation of the completely mixed system. For new plants, other reactor systems, notable a plug flow or multi-step simulated plug flow system, would offer theoretical advantages of smaller overall reactor volume as well as an improved quality of product, resulting from minimizing short circuiting, and may appear as a reduced level of pathogen in the exit sludge. The mixing requirements of the digester must be considerted in the planning stages. The other major processing input responsible for governing reactor size is the increased rate of reaction at higher temperatures, enabling smaller reactors to be used. To avoid a thermal shock situation within the reactor, raw sludge feeding rates must also be considered. Sludge feeding systems should also be considered, as should digester control systems, construction materials for use in provision of reactor volume and gas production, energy studies including gas usage, insulation and heat recovery techniques. (Baker-FRC)
W83-01353

EVALUATION OF THE USE OF IODINE FOR DISINFECTION OF EFFLUENT FROM ON-SITE 'PACKAGE' WASTEWATER TREATMENT SYSTEMS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
T. J. Whitehill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146662, Price codes: A03 in paper copy, A01 in microfiche. Masters' Thesis, May 1982. 33 p, 5 Fig, 4 Tab, 10 Ref. OWRT-B-122-PA(2). 14-34-0001-0245.

Descriptors: *Disinfection, *Iodine, *Wastewater treatment, *Effluent, *On-site treatment, Domestic wastes, Cost analysis, Chlorination, Sand filters, Organic matter.

Iodine was shown to be a feasible alternative as an agent for the disinfection of wastewater effluent from small 'package' wastewater treatment systems. The primary advantage associated with the use of an iodine crystal column iodinator rather than an erodible chlorine tablet system for wastewater effluent disinfection is the longer intervals between disinfection agent replacement for the iodine unit. The estimated additional cost to the user is $6.33 per month for the disinfection of effluent from a single-family wastewater treatment unit. Contact tank design and the degree of treatment prior to disinfection can affect greatly the performance of the crystal column iodinator as well as the rate of iodine consumption. Plug flow contact tanks should be used whenever possible and should be designed to provide the recommended 20 to 25 minutes contact time. If the wastewater is to be used for the dissolution of the iodine crystals, it should first be passed through a sand filter. If a sand filter is not used, then the possibility of organic fouling of the iodine crystals exists and a separate clear water line may have to be used for dissolution of the iodine crystals. The recommended ratio of wastewater effluent flow to clear water

flow is approximately 30:1 in order to provide for sufficient dissolution of iodine. The iodine crystal iodinator operated 2 months without refilling, compared with 3 to 4 weeks for erodible chlorine tablet systems. (Moore-SRC)
W83-01361

AN INVESTIGATION INTO THE REMOVAL OF ALGAE BY FINE SAND/SILT FILTRATION,
Louisiana Water Resources Research Inst., Baton Rouge.
B. Naghavi, and R. F. Malone.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146720, Price codes: A08 in paper copy, A01 in microfiche. Report, November 1981. 153 p, 9 Fig, 5 Tab, 48 Ref, 2 Append. OWRT A-052-LA(1).

Descriptors: *Algae, *Sand filters, *Wastewater treatment, *Water treatment, *Filtration, *Scenedesmus, Silt, Head loss, Particle size, Cholorphyll A.

One of the problems in water and wastewater treatment is the lack of an economical technology to remove algae from eutrophic surface waters and stabilization ponds. A laboratory scale study was undertaken to determine the feasibility of a method of filtering algae from water using fine sand/silt as a filter media. Five median sand sizes (0.064 to 0.335 mm) and four bed depths (3.2 to 12.7 mm) were examined in constant head experiments with the algae Scenedesmus quadricauda. A total of 46 experiments were conducted with continuous measurements of flow rate, head loss and effluent quality. All media with median sand sizes at or below 0.200 mm gave consistently high algae removal rates. Sand with median grain size diameter of 0.200 mm with a bed depth of 3.175 mm produced an effluent quality with average removal of 96% (based on chlorophyll a). This combination of grain size and bed depth also resulted in highest initial flow rate (246 cu m/sq m/d) and lowest initial head loss (7.75 cm). Run times were short due to surface clogging of the media. No chemical addition was required to obtain high removal levels. The principal filtration mechanism with the fine sand/silt filter appears to be direct straining on the surface of the filter media. (Moore-SRC)
W83-01367

DESIGN CONSIDERATIONS FOR USE OF ON-SITE SAND FILTERS FOR WASTEWATER TREATMENT,
Pennsylvania State Univ., University Park. Research on Land and Water Resources.
R. L. Dymond.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146738, Price codes: A10 in paper copy, A01 in microfiche. Masters' Thesis, May 1981. 206 p, 15 Fig, 23 Tab, 60 Ref, 2 Append. OWRT B-122-PA-(1). 14-34-0001-0245.

Descriptors: *Sand filters, *Wastewater treatment, *On-site treatment, *Pennsylvania, Sanitary wastewater, Domestic wastes, Disinfection, Legislation, Ultraviolet radiation, Chlorination, Filters, Septic tanks, Effluents.

Soil characteristics in much of Pennsylvania are such that a typical on-site septic tank/soil absorption system will not function properly. Also, use of such typical systems is limited in many areas by the depth to the ground water table. It is felt that an enclosed sand filter system with surface discharge would be the most successful method of providing on-site wastewater treatment where unsuitable conditions are encountered. Three major sand filter system alternatives were investigated: the recirculating sand filter, the buried sand filter, and the intermittent sand filter. The buried sand filter is the most outdated and least efficient. The recirculating sand filter system is subject to freezing, and it is a complicated system. The most economically and technologically feasible system is the intermittent type sand filter. This filter usually follows a pretreatment unit such as a septic tank, and has the capability of providing for the release of the effluent into the ground or to surface waters. Disinfection is usually produced by chlorination (tablet erosion) or ultraviolet irradiation. The major problem with on-site sand filter systems is the required maintenance, without which the system is sure to fail. The necessary maintenance requirements are determined by the sand size. To aid in establishing the present legislative viewpoint on various on-site surface discharge systems including sand filters, a survey was conducted of all state legislation and recommendations. (Moore-SRC)
W83-01368

5E. Ultimate Disposal Of Wastes

LEACHING OF CADMIUM FROM PIGMENTED PLASTICS IN A LANDFILL SITE,
Harwell Lab., Oxon (England).
For primary bibliographic entry see Field 5B.
W83-01068

PROTECTING PUBLIC GROUNDWATER SUPPLIES,
For primary bibliographic entry see Field 5G.
W83-01071

SEDIMENTAL JOURNEY,
Texas Agricultural Extension Service, College Station.
J. M. Sweeten.
Feedlot Management, Vol. 23, No. 4, p 26, 28, 32, April, 1981. 1 Tab.

Descriptors: *Feedlot runoff, *Feedlot wastes, *Waste management, Animal wastes, Farm wastes, Barn wastewater, Agricultural runoff, Manure, Drying, Sedimentation, Dredging, Land disposal, Sludge, *Texas.

Sediment in feedlot runoff holding ponds is difficult and expensive to remove, haul and spread. Containing up to 10-20% solids, it is too thick for pumping and too fluid for efficient dredging operations. Sediment removal operations were studied at a 25,000 head feedlot in Southwest Texas. The dirt-surfaced feedlot occupies 93 acres including feed pens, alleys, mill area and cattle handling facilities. All runoff is channeled into three holding ponds with a combined capacity of 44 acre-feet. Runoff from 13 inches of rainfall in a 30 day period plus 12 years acculation of sediment left the holding ponds full despite regular liquid withdrawals for irrigation of 300 acres of alfalfa. Electric centrifugal irrigation pumps were used to restore system capacity. Subsequently, following a short drying period, sediment was excavated using a dragline. Analytical results showed that total salts would be the limiting factor in land disposal of this effluent. Because of the fluid consistency of the sediment, a full dragline bucket contained only 0.85 cubic yard of sediment. Four to six weeks later, sediment was removed from the drying trenches, loaded into a conventional feedlot manure spreader truck, and applied to alfalfa and fallow sorghum fields. The sediment still contained more than 65% moisture, which hampered the loading and spreading operation. (Baker-FRC)
W83-01140

SLUDGE MARKETING: THE QUIET REVOLUTION,
K. C. Flynn.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1267-1269, September, 1982.

Descriptors: *Sludge disposal, *Soil amendments, *Land application, Milorganite, Composting, Land disposal, Land reclamation, Heavy metals, Cadmium, Pretreatment of water.

Above 50% of the nation's sewage sludge is now applied to the land. This shift toward land disposal was influenced by a turn away from ocean dumping and by the development of a simple composting technique. Wastewater pretreatment has reduced the levels of heavy metals, especially cadmium, in the sludge. Among the communities marketing or giving away sludge are Milwaukee, Wisconsin (60,000 tons per year of Milorganite); Philadelphia (liquid Philorganic and dried Gardenlife); Los Angeles; Washington, D. C. (product used in many nearby National Parks); Salem, Oregon (Biogro, a liquid), and Madison, Wisconsin (Metrogro, liquid sludge injected into farmland). Although sludge marketing programs are usually operated at a loss, they are nevertheless a low cost and environmentally acceptable disposal alternative. Users of sludge include commercial growers, landscapers, contractors, farmers, and home gardeners. Composted sludge finds use in three markets: intensive plant culture, restoration of lands disturbed by mining or construction, and as a soil conditioner for crop lands. Regulations on sludge application have not been issued on the federal or state level. (Cassar-FRC)
W83-01208

MICROBIAL CONTAMINATION OF CONTINENTAL SHELF SEDIMENTS BY WASTEWATER SLUDGE,
Environmental Protection Agency, Annapolis, MD.
For primary bibliographic entry see Field 5B.
W83-01214

WHERE WE ARE BUT WHERE ARE WE GOING,
D. V. Feliciano.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1259-1266, September, 1982. 4 Tab.

Descriptors: *Sludge disposal, *Land disposal, *Wastewater management, Financial aspects, Heavy metals, Pathogens, Organic compounds, Water pollution sources, Public opinion.

Management of municipal sludge remains a difficult problem. Land application is considered, with emphasis on proper management, reclamation of resources, risk considerations, and a review of the realities of sludge. Sludge management in the US is accomplished through five basic options: land application, landfilling, incineration, ocean disposal, and others such as lagooning. The advantages of land application are that sludge, stabilized either through digestion or composting to a form that can be used again, is applied to the land in either an agricultural setting as a fertilizer or soil conditioner or in a reclamation project to recover an area that was previously of little value. Problems include a shortage of available land, transportation costs, and need for interstate transport. Of significant concern is the quantity of undesirable substances in the sludge, including pathogens, organic chemicals and heavy metals. Before land application can be broadly accepted by the public, an extensive education program is needed to explain potential hazards and quiet the fears. (Baker-FRC)
W83-01215

PATHOGENIC AMOEBAE IN OCEAN SEDIMENTS NEAR WASTEWATER SLUDGE DISPOSAL SITES,
National Marine Fisheries Service, Oxford, MD.
For primary bibliographic entry see Field 5C.
W83-01216

EFFLUENT--A QUESTION OF SLUDGE,
T. D. Salter.
Water Services, Vol 86, No 1037, p 329-330, July, 1982. 2 Fig.

Descriptors: *Dewatering, *Sludge filters, *Filters, *Sludge disposal, Compaction, Vacuum filters, Sludge thickening, Sludge volume index.

Sludge compaction on site may reduce costs for plants with a sludge production greater than 9000 liters per week. A content desirable for shoveling and stacking is about 10-25%. A graph shows the sludge volume of a 2% sludge at various residual solid levels. Sludge volume decreases rapidly from 2% sludge solids (10,000 units of volume) to 10% (2500 units), slowly from 10% to 25% (1000 units), and very slowly from 25% to 50% (500 units). Two common filters are used for sludge compaction; filter presses and vacuum filters (rotary drum, rotary belt, or horizontal belt). Choosing a suitable

system depends on the nature of the sludge and other factors. (Cassar-FRC)
W83-01334

PRIMARY SLUDGE MASS FLOW MEASUREMENT,
M. R. Bowers.
Water Services, Vol 86, No 1037, p 333, July, 1982. 2 Fig.

Descriptors: *Sludge solids, *Flow measurement, Automation, Equipment, Measuring instruments, Wastewater treatment, Sludge disposal, *England.

A primary sludge mass flow measuring system was installed at the Haven Road Works, Anglian Water Authority. A magnetic flowmeter and a density meter determine the volume and density of sludge, respectively, from which the dry solids weight may be calculated automatically. Measurements are done during pumping of sludge into the tank trucks which transport sludge. The measurement system saves operating costs by making it possible to transport sludge when it is near the optimum density, 6%. Previously, tankers removed sludge on a scheduled basis regardless of sludge density, which sometimes was as low as 1%. Use of the new system has resulted in fewer truck trips and a better, more uniform sludge density. Equipment for an on-line automatic desludging system has been installed in a pilot project. This removes sludge whenever it reaches a predetermined density. (Cassar-FRC)
W83-01336

FRITO-LAY TURNS WASTE INTO PROFIT.
For primary bibliographic entry see Field 5D.
W83-01351

5F. Water Treatment and Quality Alteration

PROGRESS TOWARD A SOLUTION TO THE NITRATE PROBLEM,
Minnesota Univ., Minneapolis. Dept. of Chemistry.
M. M. Kreevoy, and C. I. Nitsche.
Environmental Science and Technology, Vol 16, No 9, p 635-637, 1982. 2 Fig, 21 Ref.

Descriptors: *Water treatment, *Solvent extraction, *Nitrates, Membrane processes, Nitrogen removal, Industrial wastes, Benzene, Trioctyl phosphate, Phosphates, Water pollution sources.

Excessive nitrate ion in drinking water is a widespread problem resulting from agricultural and industrial activity, domestic sewage and auto exhausts. Solvent extraction may prove helpful in controlling this situation. The equilibrium constant for the extraction of nitric acid from water by a fatty amine in a water-immiscible liquid is increased by a factor of 100 when the solvent is changed from benzene to trioctyl phosphate. This permits the hydrogen and nitrate ions to be coextracted from a near-neutral solution. The amine solution in trioctyl phosphate can be carried on a thin porous plastic support and used as a membrane. Such a membrane has been mounted in a modified dialysis cell, with loading carried out on one side and stripping with base on the other. This device is efective in removing nitrate from water. (Baker-FRC)
W83-01072

DYNAMICS OF BIOFILM PROCESSES,
Nalco Chemical Co., Naperville, IL.
For primary bibliographic entry see Field 5D.
W83-01080

WATER QUALITY ASSURANCE BY PHOSPHORUS REDUCTION IN DRINKING WATER RESERVOIRS (SICHERUNG DER TRINKWASSERGUTE ALS FOLGE VON PHOSPHORELIMINIERUNGSMASSNAHMEN AND TRINKWASSERTALSPERREN),
Wahnbachtalsperrenverband, Siegburg (Germany, F.R.), English Summary.
H. Bernhardt.
Zeitschrift fur Wasser and Abwasser Forschung, Vol 15, No 3, p 157-164, June 1982. 8 Fig, 2 Tab, 35 Ref.

Descriptors: *Drinking water, *Phosphorus removal, *Reservoirs, *Algal growth, *Eutrophication, *Federal Republic of Germany, Wahnbach reservoir, Filtration, Flocculation, Water treatment, Disinfection, Chlorination, Organic compounds, Trihalomethanes, Taste, Odor.

The effects of periodic mass growth of algae on the quality of drinking water from eutrophic reservoirs are described using the Wahnbach reservoir (Federal Republic of Germany) as an example. Dissolved organic compounds formed in stored water and particulate organic substances are mainly responsible for algal bloom. Problems in water treatment caused by these conditions are not fully measurable and cannot always be controlled with certainty using existing treatment methods. Particularly in small reservoirs, the extraction of water from the hypolimnion can result in almost the entire reservoir changing to epilimnion and thus to an algal production zone. Massive development of siliceous algar (2,700 cells/ml) at Wahnbach in 1972-3 shortened filter lifetime to 8 hours. Zooplankton such as Keratella cochlearis can free themselves from oxidehydroxide flocs and break through the filter to drinking water. Some organic compounds formed from algae consume chlorine, resulting in a need for additional chlorine input for disinfection purposes. These compounds also possess precursor properties and during chlorination form trihalomethane compounds which may appear in drinking water. Inadequate disinfection allows possible reproduction of algae in the water supply; at Wahnbach this danger increased when the dissolved organic matter content in treated drinking water exceeded 1 mg/1. This occurred during a mass bloom of Oscillatoria rubescens at the end of the 1960s and increased during the blue and green algal bloom of the 1970s. Since the introduction of a phosphorus-removal plant at the reservoir, the dominat blue algae have disappeared and green-algal development is slight. Water-treatment procedures have been significantly simplified in the now-mesotrophic reservoir. (Gish-FRC)
W83-01114

REMOVAL OF HUMIC SUBSTANCES AND TURBIDITY IN WATER SUPPLY SOURCES BY POLYMER COAGULATION AND DIRECT FILTRATION,
Massachusetts Univ., Amherst Water Resources Research Center.
F. A. DiGiano, E. J. LaMotta, K. B. Black, and M. C. Zapata-Moreno.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139857, Price codes: A04 in paper copy, A01 in microfiche. OWRT A-116-MASS(1), 14-34-0001-9023. Publication No. 124, July, 1981. 46 p, 2 Tab, 17 Fig, 26 Ref, Append.

Descriptors: *Turbidity, *Color, Drinking water, Treated water, *Water treatment, *Chlorination, *Coagulation, *Filtration, Clarification, *Chemical treatment, *Cost analysis, *Polymers, Water supply, Water quality standards, Treated water, *Trihalomethane formation, *Massachusetts, Drinking water standards, New England.

Many protected surface water supplies in New England receive no treatment other than chlorination and corrosion control. These waters are generally low in both alkalinity and turbidity and low to moderate in natural color. More stringent limits on turbidity and trihalomethanes (which are produced when waters containing natural color are chlorinated) may force many communities to construct expensive conventional filtration plants. This research attempted to investigate use of a cationic polymer as the primary coagulant with the dual objectives of removing turbidity and organic precursors to trihalomethane production. Such a procedure might be an alternative to direct filtration. A leaf and soil extract provided the source of turbidity and trihalomethane formation potential (THMFP) in laboratory filtration of a low alkalinity water supply. The cationic polymer, Betz 1190, in a dosage of about 7 mg/1 gave a good performance over a fairly wide range of influent turbidity (6 to 15 NTU) and (THMFP) (315 to 562 ug/1). Filter run times varied from 6.5 to 12.5 hours before turbidity exceeded 1 NTU; color removal varied from 66 to 83 percent and THMFP from 45 to 55 percent. The results are especially promising given that a rather high application rate of 6 gpm/ft2 was used.
W83-01239

THE INFLUENCE OF ALGAL GROWTH AND OTHER ECOLOGICAL FACTORS IN RESERVOIRS ON THE PRODUCTION AND CONTROL OF TRIHALOMETHANE PRECURSORS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
R. C. Hoehn, C. W. Randali, J. K. Malone, and K. L. Dixon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-140012, Price codes: A07 in paper copy, A01 in microfiche. Completion Report, January, 1982. 143 p, 41 Fig, 6 Tab, 59 Ref, Append. OWRT-A-087-VA(1).

Descriptors: Drinking water, Water treatment, Algae, Reservoirs, Trihalomethane precursors, Lake water organics, *Trihalomethanes, *Algal growth, *Dissolved organic carbon, Chloroform, Alum coagulation, *Virginia, Claytor Lake, Water pollution treatment.

The objective of the research was to assess the importance of biological activity in a reservoir in altering the nature of the dissolved organic carbon (DOC) content, especially that portion of the DOC that serves as precursors for trihalomethanes (THMs), such as chloroform, that form when water is disinfected with chlorine during drinking-water treatment processes. The study also sought to evaluate the effectiveness of alum coagulation for removing THM precursors. Lake water was fractionated into its hydrophilic and hydrophobic solubility classes; these fractions were analyzed for the DOC content and THM-formation potential. Algal productivity and extra-cellular product during a six-hour period was determined, and the incubated lake-water samples were also fractionated. Diurnal studies were made to relate primary productivity and extracellular product to daily variations in the lake's DOC concentrations and THM-formation potential. Results showed that the majority of lake water DOC and THM-precursors were hydrophobic in nature. The diurnal studies provided strong evidence that both the algal and heterotrophic populations are involved in the production of THM precursors. Aluminum sulfate was moderately effective for removing THM precursors from lake water. There seemed to be no relationship between alum's effectiveness and the population densities of algae and bacteria, but the effectiveness on a diurnal basis as algal growth varied was not evaluated.
W83-01279

OPERATIONAL EXPERIENCES WITH A PULSATOR CLARIFIER TREATING A COLOURED UPLAND WATER,
Strathclyde Regional Council (Scotland). Water Dept.
C. J. McFadzean.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 2, p 144-150, March, 1982. 3 Fig, 4 Tab.

Descriptors: *Color removal, *Clarifiers, *Water treatment, Corsehouse Treatment Works, Strathclyde Region, *Scotland, Pulsator clarifiers, Filtration, Sludge, Alum, Lime, Flocculation.

The semi-automatic Corsehouse Treatment works, commissioned in August 1976 by the Strathclyde Regional council, consists of coagulation, flocculation, sedimentation, clarification, filtration, chlorination, and pH correction. A typical raw water color is 120 degrees H, with some colors as high as 350 degrees H. The pulsator consists of a vertical flow clarifier. A centrally placed vacuum chamber receives water from the flash mixer and distributes the water to the pulsator through a system of

channels and perforated pipes near the floor of the tank. A vacuum pump in the chamber causes the water to rise to a predetermined level, at which the vacuum is broken and the water is expelled in a quick pulse through the channels and pipes into the tank. The duration of rise and fall of the water level has been 39-43 sec and 13-14 sec, respectively, over a flow range of 2200-5200 cu m per day, raw water colors of 60-350 degrees H, and water temperatures of 1 to 16 C. It appears that the pulsator is not necessary for control of the sludge blanket, but it reduces alum carry-over to the filters, increases the percentage of solids in the sludge drawn off, and allows quick return to stable conditions following adjustments. (Cassar-FRC)
W83-01302

CORRELATION PROCEDURES TO REDUCE WATER LOSSES (KORRELATIONSVERFAHREN ZUR WASSERVERLUSMINDERUNG),
Technische Werke der Stadt Stuttgart A.G. (Germany, F.R.).
H. Berge, and C. Laske.
Gas- und Wasserfach: Wasser/Abwasser, Vol 123, No 6, p 288-293, 1982. 11 Fig, 4 Ref. English summary.

Descriptors: *Correlation analysis, *Leakage, *Water loss, *Pipelines, *Networks, Water conveyance, Water pressure, Noise, Mathematical analysis, Water distribution, Drinking water, Stuttgart, Federal Republic of Germany.

Water losses of 14% (8 million cu m/yr) were occurring in the 2,100-km long pipe network of the City of Stuttgart (Federal Republic of Germany) Technical (Water) Works, prompting the use of a correlation procedure to locate leaks. This method is less susceptible to interference from outside noise and its results less dependent on the properties of the sounding equipment than the conventional 'bugging' method. The procedure works by means of pressure sensors which receive sound signals from one or two points along the pipe network and transmit them through a filter to a correlation analyzer. The analyzer performs cross-correlation when two signals are received and auto-correlation with one signal. The method uses the phenomenon that a leak produces pressure fluctuations in the water column that are transmitted to either side of the pipe and cause sound changes in both the fabric of the pipe and the water itself. Both water and pipe sound can be used for analysis; the reflection of water sounds in the pipe fabric may also be used with auto-correlation (one-point method). An example of the use of the two-point (cross-correlation) method with pipe sound is reported: analysis indicated the presence of a leak only 0.11 m from the actual leak. The one-point method with water sound, utilizing a reflection of the original sound, indicated a leak directly adjacent to the actual location. For the two-point method, a distance of 80-100 m between sensors is recommended. A deviation of + or - 0.7 m of the indicated leak from the actual location is considered acceptable, because then the actual leak will be uncovered by excavation. The one-point method is advantageous with long pipe sections, while the two-point method is better for intermeshed networks. The two-point method with pipe sound produces either an unmistakable indication or none at all. (Gish-FRC)
W83-01305

ACUTE FLUORIDE POISONING ASSOCIATED WITH AN ON-SITE FLUORIDATOR IN A VERMONT ELEMENTARY SCHOOL,
Vermont State Dept. of Health, Burlington.
For primary bibliographic entry see Field 5C.
W83-01329

THE U.S.: RETHINKING FILTRATION AND DISINFECTION,
Camp, Dresser and McKee, Inc., Boston, MA.
P. W. Prendiville.
Consulting Engineer (St. Joseph), Vol 59, No 3, p 79-82, September, 1982. 1 Fig.

Descriptors: *Drinking water, *Water treatment, *Water quality, Turbidity, Water treatment facilities, Europe, United States, Asbestos, *Filtration, *Ozonation, Adsorption, Carbon, Organic compounds, Public health.

Under the Clean Drinking Water Act, the EPA promulgated standards for maintaining turbidity levels of less than 1.0 units. Some states have set even stricter standards. If turbidity levels of under 1.0 units are required, water filtration is necessary. Filtration is also needed to guard against Giardia lamblia and Naegleria. Direct filtration plants using sand, coal, or dual media have been designed for large cities in the US and abroad. Filtration also removes the cause of primary amoebic meningoencephalitis and removes asbestos fibers from upland sources of surface water supplies. Filtration in many cases will not adequately remove organic precursors, and in such cases the adsorption of the organics on granular activated carbon can be considered. The combination of ozonation and direct filtration is being tried in Los Angeles to meet strict turbidity standards in a cost effective manner. The European water treatment philosophy is not only to treat poor quality water with sophisticated treatment trains but to produce drinking water similar in quality to natural spring water. (Baker-FRC)
W83-01331

EGHAM EXPANSION PROVIDES BULK WATER SUPPLY.
Water Services, Vol 86, No 1037, p 318-321, July, 1982. 6 Fig.

Descriptors: *Water supply, *Pumping stations, *Pipelines, Reservoirs, Case studies, Water treatment, Water distribution, Egham Works, North Surrey Water Company, *England.

A new reservoir and associated transmission lines were built to increase the water supply of the 90-year old Egham Works of North Surrey Water Company by 14 M liters per day. A new pumping station and upgrading of the rapid gravity filters increased throughput to 110 M liters per day, with provisions for a future expansion to 136 M liters per day. The plant draws its water from the River Thames and the groundwater-fed Queensmead Lake. A 900 mm cement mortar lined ductile iron pipeline over 20 km long was installed between the new Surrey Hill Reservoir and the treatment works. The reservoir, 110 m x 69 m x 6 m depth, will store about 45 M liters. (Cassar-FRC)
W83-01335

HYDROTEC - A GEOTEXTILE WATER WELL SCREEN,
R. H. Thomas.
Civil Engineering (London), p 35, 37, 38, July, 1982. 5 Fig, 1 Tab.

Descriptors: *Wells, *Screens, *Water quality control, Water pollution sources, Well screens, Well water, Drinking water, Potable water.

Recent attempts to improve the efficiency of well screens have usually centered on the development of screens having a higher open area ratio and the introduction of an artificially installed gravel pack. Both metallic and plastic screen types have been tried. Alternatively, the gravel pack solution allows the use of a coarser slot width in fine grained soils and relies on a pack of coarser material to retain the formation. Hydrotec was designed to overcome all basic problems, to provide a highly efficient well screen system that can be used in any kind of aquifer without recourse to a gravel pack. The screen consists of three plastic sleeves surrounding a central base pipe. The pipe provides support and high collapse resistance required by the well screen. The efficiency of the Hydrotec screens has been tested in the lab against commercially available well screens. Their efficiency has also been demonstrated in the field. (Baker-FRC)
W83-01345

PITLESS EQUIPMENT,
K. McCray.
Water Well Journal, Vol 36, No 9, p 48-49, September, 1982.

Descriptors: *Wells, *Equipment, Well regulations, Well casings, Regulations.

There are three types of pitless well equipment, designed to reduce well water contamination by surface runoff: the pitless adapter, the pitless unit and the above-ground discharge unit or diverter. The use of a pitless adapter requires digging a trench around the well casing to the lovel where the adapter connection will be made. This connection is below the soil freeze line. There are three basic adapter designs: compression gasket, saddle compression and weld-on style. Many models and brands of pitless equipment are on the market, but some states permit the use of only certain products. Contractors should contact state or local health officials to learn which are acceptable to their locality. (Baker-FRC)
W83-01349

TREATMENT TECHNOLOGY TO MEET THE DRINKING WATER STANDARDS FOR TRIHALOMETHANES FOR JACKSON, MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
B. A. Mowry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146415, Price codes: A11 in paper copy, A01 in microfiche. PhD Thesis, May, 1982. 247 p, 43 Fig, 26 Tab, 59 Ref, 5 Append. OWRT B-029-MS(1). 14-34-0001-1240.

Descriptors: *Trihalomethanes, *Chlorination, *Disinfection, *Chloramines, *Drinking water, *Water treatment, Water quality, Potassium permanganate, Ozonation, Hydrogen peroxide, Ammonia, Jackson, *Mississippi, Pearl River, Chloroform.

The City of Jackson, Mississippi, acquires the bulk of its water from the Pearl River. Total trihalomethane (TTHM) concentrations in excess of the recommended level of 100 ppb have been found in the finished water. To arrive at an optimum solution to the TTHM problem, a study was initiated with the primary objective of delineating the most cost effective treatment sequence, meeting the EPA requirement for TTHM without sacrificing other water quality criteria. Studies on the removal of precursors, prevention of trihalomethane (THM) formation, and post treatment for the removal of tHM produced were carried out. Process modifications studied through pilot plant operation include: relocation of the chlorine application point; chlorination/ammoniation; chlorination/potassium permanganate oxidation; and chlorine dioxide utilization. Batch studies included: jar tests to determine the optimum conditions for coagulation; rate of THM formation studies to evaluate the effects of temperature, pH and chlorine dose on the rate of THM formation; aeration studies as a post treatment method for the removal of THM; and oxidation studies through ozone, hydrogen peroxide, chlorine dioxide and potassium permanganate to assess the effects of these oxidizers on precursors removal. Chloramines are the most cost effective and implementable option, as a substitute for prechlorination process, that will satisfy the objectives of controlling THM formation as well as providing the necessary disinfection. (Moore-SRC)
W83-01360

AN INVESTIGATION INTO THE REMOVAL OF ALGAE BY FINE SAND/SILT FILTRATION,
Louisiana Water Resources Research Inst., Baton Rouge.
For primary bibliographic entry see Field 5D.
W83-01367

5G. Water Quality Control

2,4,6-TRINITROTOLUENE-SURFACTANT COMPLEXES: DECOMPOSITION, MUTAGENICITY, AND SOIL LEACHING STUDIES,
Army Natick Research and Development Lab., MA.

For primary bibliographic entry see Field 5B.
W83-01067

THE DEFINITION AND USE OF MIXING ZONES,
Dow Chemical Co., Midland, MI.
W. B. Neely.
Environmental Science and Technology, Vol 16, No 9, p 518A-521A, 1982. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Mixing, *Wastewater disposal, *Outfalls, Water quality control, Destratification, Water pollution control. Wastewater.

A mixing zone is a region where dispersion occurs in all directions until the constituents in the discharge have achieved uniform concentrations in the receiving system. Mixing is important for effluent streams that contain a variety of chemicals. In the mixing zone water quality characteristics are established by determining how long the organisms will be exposed to the water and their response during this time. The boundary of the mixing zone is the point beyond which the response of the organisms to the water no longer depends on the length of time they are exposed. The mixing zone should be established by a combination of physical, biological, and political considerations weighed and used together to define the allocated impact zone. A numerical example is offered of how the effluent concentration may be estimated for a discharge to a typical river. Once the geometry of the mixing zone is known, it becomes possible to estimate the limitations that must be placed on the discharge to achieve the Water Quality Standard at the boundary of the designated zone. (Baker-FRC)
W83-01070

PROTECTING PUBLIC GROUNDWATER SUPPLIES,
J. Josephson.
Environmental Science and Technology, Vol 16, No 9, p 502A-505A, 1982. 2 Fig.

Descriptors: *Groundwater pollution, *Water pollution sources, *Waste disposal, Liners, Landfills, Waste dumps, Groundwater, Path of pollutants, Permeability, Leaching, Regulations, EPA.

Leachates from improperly constructed wastewater impoundments and waste disposal sites form a major threat to groundwater from which public drinking water and industrial water supplies are taken. With the primary aim of preventing contaminants from leaching out of waste disposal sites, EPA issued its long awaited regulations governing the placement of hazardous wastes in landfills, surface impoundments, and other repositories. The major regulatory provision requires liners of plastic or other synthetic material at landfills. Another provision calls for a backup leachate collection system to catch any hazardous liquids before they can reach groundwater. Various areas of study have been examined regarding liners, including tests on liner materials, liner caveats, clay liner tests and subterranean interactions when liners prove faulty. Use of digital computer models for predicting the migration of contaminants from their sources into groundwater is discussed. Means of assessing contamination are presented. (Baker-FRC)
W83-01071

CONTROL BY ALKALINE NEUTRALIZATION OF TRACE ELEMENTS IN ACIDIC COAL CLEANING WASTE LEACHATES,
Los Alamos National Lab., NM.
L. E. Wangen, and J. M. Williams.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1302-1310, September, 1982. 1 Fig, 6 Tab, 9 Ref.

Descriptors: *Leachates, *Acidic water, *Metals, *Wastewater treatment, Industrial wastewater, Solubility, Coal wastes, Trace elements, Speciation, Adsorption, Neutralization, Lime, Model studies, MINEQL model.

The effect of calcium hydroxide neutralization of acidic coal cleaning waste leachates on the speciation of trace metals was calculated by a complex chemical equilibrium model (MINEQL) and compared with laboratory results. Good agreement was obtained for fluorides, Al, Ca, Fe(++), and Fe (3+). Model results were substantially higher than observed results for concentrations of the dissolved species, As, Cd, Co, Cr, Cu, Mn, Ni, and Zn. Concentrations of soluble components decreased with increasing pH over the range studied, 2.25-10.18. The alkaline neutralization of these leachates was an effective method of reducing pollutants. Al and Fe hydroxides, calcium sulfate, iron carbonate, calcium fluoride, and other solids present in the neutralized solution can also remove trace metals from solution by adsorption. (Cassar-FRC)
W83-01075

WATER QUALITY ASSURANCE BY PHOSPHORUS REDUCTION IN DRINKING WATER RESERVOIRS (SICHERUNG DER TRINKWASSERGUTE ALS FOLGE VON PHOSPHORELIMINIERUNGSMASSNAHMEN AND TRINKWASSERTALSPERREN),
Wahnbachtalsperrenverband, Siegburg (Germany, F.R.), English Summary.
For primary bibliographic entry see Field 5F.
W83-01114

ENVIRONMENTAL IMPROVEMENT ON NARRAGANSETT BAY AS A RESULT OF SECTION 312 IMPLEMENTATION OF THE FEDERAL WATER POLLUTION CONTROL ACT,
Rhode Island Univ., Kingston.
N. West, C. Heatwole, and L. Smith.
Coastal Zone Management Journal, Vol 10, No 1/2, p 125-140, 1982. 1 Tab, 13 Ref.

Descriptors: *Regulations, *Wastewater disposal, *Boating regulations, *Coastal zone management, *Narragansett Bay, *Rhode Island, Federal Water Pollution Control Act, Clean Waters Act, Recreation, Wastewater treatment, Toilets, Ships, Biological oxygen demand, Water pollution sources, Legal aspects.

A conceptual model was developed to evaluate the daily effluent load generated by recreational boats, which, like all vessels larger than 21 ft, are required to have Marine Sanitation Devices (MSD) as described in Section 312 of the Clean Waters Act. These regulations, which govern lakes and coastal waters, are intended to prevent untreated wastewater from entering the marine environment. A survey on Narragansett Bay, Rhode Island, during the summer of 1980 was used to develop the empirical model. Two types of MSD's require either an electric connection and/or addition of chemicals. They discharge treated effluents and chemicals to the receiving waters. The third type holds untreated waste until it can be pumped out at a shore facility. Calculated BOD per boating day was 3018 pounds, equivalent to a population of 686 persons. Costs were estimated for installing MSD's (at $100-$1500 each), shore pumping facilities ($2500-$3000 per year for 20 years), and treatment in municipal systems. These figures indicated that the cost of treating 1 pound of BOD was 30 cents. Potential adverse effects of enforcing these regulations are pollution from treatment chemicals (chlorine and compounds, formalin) and overloading of ill-equipped municipal sewage treatment plants. It is suggested that the regulations be applied on a geographical basis, exempting water bodies with good flushing action like Narragansett Bay, which are capable of efficient dilution and degradation of organic wastes at the levels generated there. (Cassar-FRC)
W83-01130

WASTEWATER TIGHT,
G. Ashfield.
Feedlot Management, Vol. 23, No. 4, p 6-7, 9, April, 1981.

Descriptors: *Feedlot runoff, *Feedlot wastes, *Waste management, Animal wastes, *Wisconsin, Farm wastes, Barn wastewater, Agricultural runoff, Manure, Construction, Terrace channels, Terracing, Land disposal, Water pollution prevention.

Efforts undertaken on a local farm in Darlington, Wisconsin, to improve water quality in the surrounding area are described. These efforts include the construction of two 200-head capacity feedyards, one with a 2 foot high retaining wall and the second with a 4 foot high retaining wall. The system effectively retains manure without the employment of a lagoon. About twice a month workers enter the concrete feedyards with a skid-steer loader, load the manure into a box spreader and spread it on nearby cropland. Liquid runoff from the feedyards passes through a picket section at the southeast corner of each yard. From there a gentle slope carries it down separate terraces, 140 and 176 ft in length. Most of the liquid runoff will be either absorbed or evaporated before reaching the far end, but in the event of a heavy rainstorm causing sufficient liquid to flow past the terraced section, a grass channel running along the south border of the field will halt the runoff and deny access to the many springs and streams in the area. (Baker-FRC)
W83-01141

WATER REGULATIONS,
League of Nebraska Municipalities, Lincoln.
For primary bibliographic entry see Field 6E.
W83-01144

A RIVER STUDY,
Soil and Water, Vol. 16, No. 6, p 14-16, December 1980. 1 Fig.

Descriptors: *Rivers, *Recreation, *Water resources development, Planning, Water quality, Water pollution control, Indusrial wastes, Fauna, *New Zealand, Waikato River.

The Waikato River in New Zealand flows for 14.5 km and drops three meters, with an average width of 80 meters. Dredging has created a uniform depth by deepening the western side of the river and preventing the buildup of sediment. Within Hamilton City the river has six small tributaries with banks of easily-erodible Hinuera sands. The main problems encountered are erosion and sedimentation . At present a wide range of organizations govern the use of an access to rivers and waterways. Because rivers are protected in a somewhat fragmentary way by wide range of Acts, the Commission for the Environment has suggested the introduction of a Wild and Scenic Rivers Protection Act to ensure that rivers will be protected, regardless of the wishes of other bodies or individuals. Due to industrial waste discharges and the past use of septic tanks in Hamilton, pollution has increased in the Waikato River. Improved treatment methods have brought the pollution level down considerably over the past few years. Now the area along the river is very beautiful in many spots, with paths along its banks creating restful places for recreation and relaxation, as developed by the Planning Council. (Baker-FRC)
W83-01150

THE RECOVERY OF L. VESIJARVI FOLLOWING SEWAGE DIVERSION,
Lahti Municipal Lab. (Finland).
J. Keto.
Hydrobiologia, Vol 86, No 1/2, p 195-199, January, 1982. 5 Fig, 2 Tab, 14 Ref.

Descriptors: *Lake restoration, *Sewage disposal, *Eutrophication, *Finland, Water pollution control, Water quality, Lake Vesijarvi, Primary productivity.

Lake Vesijarvi is part of the Kymijoki watercourse and is located in Paijat-Hame, Southern Finland, between the Salpausselka Ridges. The lake is divided into five basins. The aim of this study was to consider restoration of the polluted L. Vesijarvi, concentrating on the main basins, Enonselka and Kajaanselka. Originally the lake was clear water, oligohumic in nature due to the rich groundwater and spring drainage, but 60 years of discharging mechanically treated sewage into the southern part of the lake polluted its waters. Eutrophication was

observed as early as the 1920s, but in the 1960s the pollution became far more obvious. Sewage was completely diverted in 1976. As a result of the diversion the bacteriological defects were eliminated within one year, restoring the recreational value of th lake. The recovery of water quality was rapid during the first two years. The oxygen content increased markedly, but hypolimnetic oxygen depletion persisted. The phosphorus content decreased about 60% and the nitrogen content about 30%. After that period the recovery slowed down. The biomass of phytoplankton decreased, but the abundance of heterocystous blue-green algae increased, causing blooms in July and August. The primary production has lately been reduced despite the lack of improvement in chemical water quality. Hypolimnetic aeration was started in order to accelerate the recovery. (Baker-FRC)
W83-01158

CHANGES IN THE PHYTOPLANKTON OF LAKE TRUMMEN INDUCED BY RESTORATION,
Lund Univ. (Sweden). Limnological Inst.
G. Cronberg.
Hydrobiologia, Vol 86, No 1/2, p 185-193, January, 1982. 7 Fig, 15 Ref.

Descriptors: *Water management, *Lake restoration, *Water pollution control, Seasonal variations, Phytoplankton, Aquatic plants, Algae, Algal growth, Sediments, Lake Trummen, *Sweden, Dredging, Wastewater disposal, Industrial wastes, Water pollution sources, Fate of pollutants.

During 1930-1957 Lake Trummen, previously an oligotrophic lake, was heavily polluted. The drainage area for the lake is 13 sq km and consists of granites and till poor in lime and basic minerals. The lake during this century has received sewage and wastewater from a flax processing factory, with the worst pollution period falling between 1936-1957. Sewage was diverted from the lake in 1958, but the lake did not recover. Extensive restoration was carried out during the summers of 1970 and 1971. About 0.5 m of FeS-enriched sediment was removed through suction dredging, and the sediments were deposited in settling ponds beside the lake. Runoff water from the ponds was treated with aluminum sulfate in order to reduce the phosphorus concentration before it returned to the lake. In 1971 the shores were cleaned and the bulk of the macrophyte vegetation was taken away. Samples for phytoplankton and chemical analyses were taken monthly at the middle of the lake at 0.2 m depth. During the period 1968-1978 the phytoplankton showed similar seasonal variations. Before restoration blue green algae were most important in the Lake Trummen plankton community. In 1970 the biomass of blue-greens was reduced to 5% of the prerestoration values. Before restoration the sediments were periodically anaerobic; after restoration the oxygen conditions improved considerably. The disappearance of the blue-green algae may be a result of nutrient reduction, improved oxygen conditions and the elimination of spores. Restoration improved the conditions in the lake drastically and started a meiotrophication, which is still going on. The phytoplankton community now has much in common with adjacent oligotrophic lakes. (Baker-FRC)
W83-01159

THE ESTUARINE ZONE, AN OVERVIEW,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
For primary bibliographic entry see Field 2L.
W83-01163

TUTIRA, A LAKE WORTH RESTORING,
Ministry of Agriculture and Fisheries, Auckland (New Zealand).
L. Teirney.
Soil and Water, Vol 16, No 1, p 10-13, February, 1980. 2 Fig.

Descriptors: *Lake restoration, *Environmental effects, *Eutrophication, Lake Tutira, *New Zealand, Recreation, Rehabilitation, Water quality, Nutrients, Phosphorus, Nitrogen, Nitrates, Ammonia, Oxygen, Seasonal variation, Oxygen depletion.

Lake Tutira, 35 km north of Napier (New Zealand), supports an abundance of wildlife, which adds to the appeal of the spot as a campground. A noticeable deterioration in the clarity of water occurred during the summer months in the 1960s. Studies made in 1970 confirmed that the lake was in an advanced state of eutrophication. With the plentiful supply of phosphorus, nitrogen, and other plant nutrients in Lake Tutira waters, conditions became very favorable for algal growth during spring. By November, the water below 10 m 70% of the lake's volume, was devoid of oxygen. Nitrates were converted to ammonia, which built up to toxic levels. Phosphorus was released from the bottom sediments. Hydrogen sulfide increased and accumulated. Attempts were made to maintain artificial mixing during the summer months. Water circulation was maintained through the use of aerohydraulic guns. Under these conditions complete deoxygenation did not occur until February, and it was restricted to depths greater than 23m, only 20% of the lake's volume. The use of the guns has undoubtedly improved the summer conditions in the lake. However, this technique treats the effects of the problem rather than the cause and is only temporary. Improved land use and management practices will help provide a long range solution to the problem. (Baker-FRC)
W83-01165

SALINE GROUND-WATER DISCHARGE TO THE SMOKY HILL RIVER BETWEEN SALINA AND ABILENE, CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
J. B. Gillespie, and G. D. Hargadine.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-237637, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-43, 1981. 71 p, 31 Fig, 3 Tab, 25 Ref.

Descriptors: *Saline water intrusion, *Groundwater movement, *Water pollution sources, *Degradation, Surface-groundwater relations, Aquifer characteristics, Geohydrology, Hydrologic properities, Subsidence, Mathematical models, Observation wells, Water sampling, *Kansas, Smoky Hill River, Solomon River.

Saline water discharges from the alluvium into the Smoky Hill and Solomon Rivers near Salina, Kansas, at about 32 cubic feet per second. Chloride concentrations at base flow increase about 800 milligrams per liter in the Smoky Hill River and 550 milligrams per liter in the Solomon River. The source of the saline water is the underlying Wellington aquifer, a zone of dissolution, subsidence, and collapse that occurs along the eastern margin of the Wellington Formation. Locally brine from the aquifer moves upward through collapse structures in the confining layer at the base of the alluvium. The brine discharge ranges from 0.3 to 0.8 cubic foot per second and the chloride load ranges from 150 to 370 tons per day. Results from a mathematical model of the flow system indicated that recharge from periodic flooding, as in 1973, was sufficient to reverse the normal (1976-77) hydraulic gradient between aquifers. Although brine discharge was temporarily reduced, saline-water discharge to the rivers was increased. Brine in the Wellington aquifer could be intercepted by wells and pumped to deep formations or stored for release to the river during high flows. The freshwater in upstream base flow could be diverted, and saline-water discharge could be retained by low-head dams in the channel for release during high flows. (USGS)
W83-01191

EFFECTIVENESS OF SEPTIC SYSTEMS IN SAFEGUARDING THE GROUNDWATER IN MAINE,
Maine Univ. at Orono. Dept. of Plant and Soil Sciences.
R. W. Black, and R. A. Struchtemeyer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-140004, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, Maine Land and Water Research Center, Orono, Aug 1982. 57 p, 19 Fig, 13 Tab, 79 Ref. OWRT A-052-ME.

Descriptors: Domestic wastes, *Groundwater protection, *Septic tanks, Septic wastewater, *Maine, *Soil adsorption systems, *Groundwater pollution, Suction lysimeters, Monitoring, Water pollution control, Plumbing codes, Nutrients, Pollutant identification.

In 1974, Maine's External Plumbing Code was revised to require on-site inspection by a Licensed Plumbing Inspector, rather than a 'perc test,' for sizing and designing subsurface soil absorption systems. Since that time, over 30,000 new systems have been installed. In this study, field monitoring of the groundwater around selected systems was conducted in order to detect potential contamination from domestic effluent. Twenty-eight test systems were selected, representing seven code-designated 'Soil Groups' and two construction calendar years, 1975 and 1977. Suction lysimeters provided water samples for NO3-N, NH4-N, PO4-P, pH, COD, and Cl- analyses. Monitoring occurred from June through October of 1980 and in March of 1981. Considering all systems, NO3-N concentrations under or within 3.1 meters of the bed ranged from 0.3 ppm to 410 ppm; NH4-N from 1.0 ppm to 126 ppm; and PO4-P from 0.003 ppm to 28.950 ppm. Within this 3.1 meter distance, 71 percent of all sites exceeded the U.S. Public Health Service drinking water standard of 10 mg/l NO3-N, and 86 percent exceeded the U.S. EPA surface water standard of 0.025 mg/l PO4-P at some time during the sampling period. Of the 61 systems reviewed, 51 percent were not installed according to Code specifications, even though they had been designed properly.
W83-01278

RECENT INVESTIGATIONS ON THE EUTROPHICATION AND RESTORATION OF LAKE CONSTANCE (NEUERE UNTERSUCHUNGEN UBER DIE EUTROPHIERUNG UND SANIERUNG DES BODENSEES),
Konstanz Univ. (Germany, F. R.) Limnology Inst.
H-J. Elster.
Gas- und Wasserfach: Wasser/Abwasser, Vol. 123, No. 6, p 277-287, 1982. 8 Fig, 55 Ref. English summary.

Descriptors: *Eutrophication, *Phosphorus, *Lake restoration, *Water quality control, *Lake Constance, Phosphorus removal, Seasonal variation, Limiting nutrients, Wastewater treatment, Primary productivity, Phosphates, Eutrophic lakes.

The present condition of Lake Constance (Federal Republic of Germany, Switzerland, and Austria) and its outlook for the future are discussed in the light of findings by the German Research Association and the International Commission for the Protection of Lake Constance (ICPLC). In January 1981 83.5% of the population equivalents in the lake's catchment area were served by wastewater-treatment facilities, and 68.5% were served by facilities with phosphorus (P) precipitation. The exponential increase of P concentration that occurred from 1950 to 1975 has reached a plateau of 80-90 microg P04-P/1. During summer stagnation, P is the most important limiting nutrient, while nitrogen and, for diatoms, silica may become limiting periodically. The key to restoration is a radical reduction in the input of P compounds that can be assimilated. A 90% reduction in P concentration is necessary to achieve oligotrophy; this corresponds to amounts present in the lake 40 years ago. Approximately 2/3 of the P in the lake originates in wastewaters, the rest stemming from sources such as agriculture and the atmosphere. Even if 90% of the wastewater P were eliminated, an oligotrophic state would not be achieved, due to anthropogenic nonpoint P sources. However, if efforts to replace phosphates in detergents by substances that do not cause eutrophication are successful, the lake may be saved from reduction processes in the sediment surfaces and their consequences. The ICPLC restoration plan must be carried out without compromise, and an extensive general water-protection plan for the entire catchment area is needed. The agricultural community must become involved, and water protection should be considered by tourists, watersport enthusiasts, and new industries. (Gish-FRC)
W83-01321

MOBILIZATION OF COPPER FROM MODIFIED PEAT BY DISSOLVED ORGANIC MATTER IN NATURAL WATERS AND BIOLOGICALLY PURIFIED WASTEWATERS,
Agricultural Univ., Wageningen (Netherlands). Dept. of Water Pollution Control.
For primary bibliographic entry see Field 5B.
W83-01341

SLIPLINING ENDS GADSDEN INFILTRATION.
American City and County, Vol 97, No 9, p 79-80, September, 1982.

Descriptors: *Sewer systems, *Leakage, *Maintenance, Leakage, Water loss, *Sliplining, Linings, Sink holes, Sewer infiltration, Infiltration.

Sink holes caused by the infiltration of soil into leaks in portions of sewer lines have been eradicated by sliplining a 2000 foot section of poorly supported sewer pipe. In effect, a new pipe was placed inside an old one. At one point pipe was heat fused into a 1000 foot flexible length. A winchline was connected to the pipe end, and the entire 1000 feet was pulled through the existing concrete pipeline. The entire 2000 foot sliplining project was completed in 48 hours. Proper preinstallation planning eliminated any inconvenient sewer system cutoff to residences. (Baker-FRC)
W83-01344

OPINION,
G. Read.
Civil Engineering (London), P 12-13, 45, August, 1982.

Descriptors: *Sewage systems, *Maintenance, *Collapse, Mechanical failure, Leakage, Sewers, Human disease, Public health, Bacteria, Overflow.

Sewer dereliction is a problem common in many cities such as Manchester, England. Sewer collapses occurring in the city necessitated a study of sewer conditions and neglect. Falling brickwork, partial collapse and resultant backing-up lead to premature overflow to the watercourses, which often run through densely populated residential area, and the health risk is obvious. Many older properties have cellars with drains leading to the sewerage system, where flooding results even after a partial collapse. Various means are considered to renovate the sewers. Relining is appealing due to cost savings and minimization of disruption, but results may not be satisfactory. The main goal must be to get the work done, and the responsibility must lie with the District Engineers. (Baker-FRC)
W83-01346

USEFULNESS OF SEDIMENT OXYGEN AS A TOOL FOR IMPOUNDMENT MANAGEMENT,
Illinois State Water Survey Div., Champaign.
For primary bibliographic entry see Field 5B.
W83-01371

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

STOCHASTIC APPROACH TO EVALUATING THE EFFECTIVENESS OF RECLAMATION MEASURES,
Akademiya Nauk SSSR, Moscow. Fiziko-Tekhnicheskii Inst.
D. D. Frolkin.
Water Resources, Vol 8, No 5, p 477-483, September-October, 1981. 5 Fig, 1 Tab, 10 Ref. Translated from Vodnye Resursy, No 5, p 29-36, September-October, 1981.

Descriptors: *Crop production, *Computer models, *Mathematical models, *Capital costs, *Stochastic process, *Land reclamation, Dynamics, *Crop yield, Evaluation, Agronomy, Irrigation operation, Model studies, Water resources development, Numerical analysis, Planning.

The possibilities of formalizing the effectiveness of capital investments in reclamation measures for agricultural production and providing a numerical solution are studied. An algorithm is illustrated using an individual economic region with one agricultural crop. Relations are given to describe the dynamics of capital investments and irrigation. Four models are given which contain variables of both the water-resource block and the agricultural block and can serve as links in the system of models for the effective use of water resources. Reclamation measures are evaluated beforehand by modeling the random variables on a computer. In the final formulation, the solution represents the sum of the deterministic and stochastic components, where the stochastic component of the solution corrects the deterministic component during practical realization of the selected variant of development and takes into account the annual changes in crop yield. The predictions obtained for optimal cropland to be planted and storage facilities needed for the harvest can be used for making decisions about investments in the current year. (Geiger-FRC)
W83-01093

EXPANSION PLANNING OF WATER SUPPLY PROJECTS IN TEGUCIGALPA, HONDURAS (AUSBAUPLANUNG VON WASSERVERSORGUNGSPROJEKTEN IN TEGUCIGALPA, HONDURAS),
Lahmeyer International G.m.b.H., Frankfurt am Main (Germany, F.R.).
H. Lutkestratkotter, and F. G. Rohde.
Wasserwirtschaft, Vol 72, No 6, p 246-249, 1982. 6 Fig, 2 Tab, 5 Ref. English summary.

Descriptors: *Water supply development, *Long-term planning, *Cost analysis, *Water resources development, Water conveyance, Water districts, Planning, Project planning, Projections, *Honduras, Tegucigalpa, Water treatment, Economic aspects, Estimated costs, Mathematical models, Model studies.

A master plan was developed to ensure an adequate water supply for the city of Tegucigalpa (Honduras) to the year 2010, when the population is expected to reach 1.9 million, up from 375,000 in 1980. During the same period water requirements are expected to increase from 80,000 to 550,000 cu m/day. The plan included the incorporation of new raw water sources, water treatment, conveyance from the supplying area, and the division of the district into eight zones from 950 to 1,300 m above sea level. It sought to minimize all fixed and variable costs falling due within the planning period and used as an aid a mathematical-numerical optimization model based on mixed whole-number linear programming. The program provided information showing in which year each available water source would have to be incorporated into the system in order to ensure the supply, the amount of water required from each source and the specific costs attached thereto (including construction and maintenance of pipelines and water treatment facilities), and costs divided according to fixed, variable, and specific costs. Annual total costs were divided according to treatment facility, and it was seen that two plants would incur high variable operation costs due to the necessity of conveying groundwater to them over large distances and height differentials. To minimize total costs it was therefore decided to decrease the water volume required from these plants as soon as new, less expensive plants were operational. All costs were calculated based on a 12% interest rate, though actual costs will depend on the rate at which the state is given credit; these problems were treated in a financial study as part of the master plan. Due to the preponderance of investment cost as compared with variable costs, no influence was expected to be exerted by interest rates on investment decisions. (Gish-FRC)
W83-01343

6B. Evaluation Process

EFFICIENCY OF RESOURCE USE UNDER SMALL-SCALE IRRIGATION TECHNOLOGY IN NIGERIA,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Economics.
P. O. Erhabor.
Technical Report No 148, Purdue University, Water Resources Research Center, June 1982. 114 p, 16 Fig, 39 Tab, 48 Ref.

Descriptors: *Irrigation, *Economic development, *Developing countries, *Linear programming, Surface irrigation, Groundwater level, *Nigeria.

Northern Nigeria is subject to periodic droughts that limit food production and increase food imports into the country. A econometric study was conducted to estimate the economic returns from adoption of small scale irrigation methods (shadoof and pump) and to indicate implications of these returns for research, extension, and government policy. A modified linear programming model was used that accounted for inputs and returns from intercropping systems. The data necessary to estimate the coefficients or parameters of the model were obtained from 114 irrigation farmers in Ringim LGA, Kano, Nigeria during the 1978/79 irrigation season. The results of the study indicated that the returns to irrigation farming with the shadoof and pump irrigation technology are quite high. Thus the benefits from promoting these small scale lift devices are worthy of consideration by policymakers interested in increasing agricultural output. A major barrier identified as limiting the expansion of irrigated land area was unavailability of water. Although there is sufficient ground water, the amount currently accessible for irrigation with pumps and shadoofs is limited. Investment in wells and ponds could increase availability. Lack of timely repair service hinders adoption of pump irrigation at present. (Nelson-Purdue WRRC)
W83-01083

INFILTRATION WELL USED IN HARDWAR WATER SUPPLY,
UP Jal Nigam, Hardwar (India).
J. P. Nigam.
Journal of the Institution of Engineers (India), Part EN, Environmental Engineering Division, Vol 62, No 2, p 84-88, February, 1982. 4 Fig, 2 Tab, 2 Ref.

Descriptors: *Well water, *Water supply, Water resources development, *Infiltration wells, Chlorination, Drinking water, Financial aspects, Cost analysis, *India, Hardwar.

The construction cost of tubewells for drinking water is very high in places such as Hardwar, where boulder stratum is located in the upper surface and rocky stratum in the deeper surfaces. Even so a poor discharge results of about 2,250 l/m (500 g/m). In the presence of any stream, construction of infiltration wells is less expensive and the discharge is high. Design of such infiltration wells depends on the discharge, groundwater level and the distance of the well from the stream. The site of the well should be selected so that the water or stream has the minimum chance to become polluted. In Hardwar two infiltration wells were constructed, and their performance is reported. Based on the characteristics of one well, depth of other wells may be designed at different distances from the stream for different discharges in such strata. Samples of water from these wells were tested and found satisfactory. The potable water may be supplied from these wells after chlorination only. (Baker-FRC)
W83-01301

WATER TRANSFER STRATEGY: ENERGY VS. AGRICULTURAL USE,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
Y. S. Fok, and C. P. Chang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146399, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 142, March 1982. 81 p, 9 Fig, 34 Tab, 8 Ref, 7 Append. OWRT B-060-HI(1). 14-34-0001-9110.

Descriptors: *Irrigation water, *Energy, *Water transfer, *Arid lands, *Water rights, *Resources

development, Social impact, Economic aspects, Cost analysis, Water use.

In some arid and semiarid regions where most water is appropriated for irrigation, water has been recognized as the most important limiting factor for energy development. Therefore, a water transfer from agricultural to energy use should be considered, since industry yields the highest value of water and thus constitutes the highest productivity. A transfer of the available water from agriculture to industry or energy in communities which are basically agricultural would tend to upset the familiar pattern of life and would result in a number of social costs to farmers and third parties. The developable amount of energy deposits, or the results of optimization, at a specified region (reach) depends on the unit energy developing cost, required kinds and levels of energy, amount of water-right-use streamflow existing at the proposed reach and other reaches, and the costs of transferring irrigated lands in the entire watershed. The required acreage of transferred irrigated lands increases as the total energy requirement increases. The incremental acreage per unit energy requirement varies for different compositions of total energy sources. To decrease the energy cost of agricultural water right reimbursement, energy developers can sell over-transferred water rights to downstream users from the reach where no more energy water is needed. Locations of extractive energy sources are fixed; however, conversion factory sitescan be in regions that have abundant water ana are close to the extraction site. (Moore-SRC)
W83-01358

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

FINANCIAL PLANNING DURING TIMES OF ECONOMIC UNCERTAINTY,

Economic and Engineering Services, Inc., Bellevue, WA.
G. S. Seleba.
Journal of the American Water Works Association, Vol 74, No 9, p 14, 38, September, 1982.

Descriptors: *Financing, *Bond issues, *Water rates, Economic aspects, Interest rates, Planning, *Utilities, Pricing, Operating costs, Debt, Costs.

Skyrocketing expenses and governmental regulations have forced water utility managers to seek additional sources of revenue. Some of the traditional revenue sources are long-term debt (general obligation bonds, special assessment bonds, and revenue bonds), equity offerings, and grant funds. About 1970 the financial climate changed for water utilities. Changes in laws precluded additional financing with general obligation bonds. Grant funds dwindled, and interest rates increased. New environmental regulations, increased construction costs, lack of new technology, construction delays, and inflation precipitated a shift from declining block rates to flat rates or inverted rate structures. Some strategies for internal expense control are reducing labor costs, scheduling construction for off-peak seasons, saving energy by retrofitting pumping stations with new equipment or by taking advantage of off-peak electric rates, and expediting billing. Possible internally generated revenue sources are higher minimum bills, an initial monthly fee, seasonal water rates, and new user charges. Innovative methods of external financing include offering attractive bonds through floating rate bonds, put bonds, warrants, and tender offerings. (Cassar-FRC)
W83-01054

FUNDING IMPROVEMENTS WITH DEBT CAPITAL AND REVENUES,

Burns and McDonnell, Kansas City, MO.
W. N. Marshall.
Journal of the Americal Water Works Association, Vol 74, No 9, p 456-459, September, 1982. 4 Fig, 1 Tab.

Descriptors: *Financing, *Economic aspects, *Capital costs, Debt, *Utilities, Construction costs, Interest rates, Bond issues, Income, Water rates, Planning.

A water utility can fund major capial improvements with a combination of bond proceeds and revenues which will minimize cash requirements and impose the lowest rate increases. Benefits of joint funding are more apparent at higher interest rates, for higher case coverage requirements, for lengthy construction programs, and for utilities with low bond ratings. A formula is given to calculate the optimum amount of new debt: D = (K1 x Ct) - n x K1 x K2 x DCs. K1 = fi(fc - 1 - k) where fi = debt service factor depending on interest rate and term of loan. fc = coverage factor, k = reciprocal of number of years required to fill the debt service reserve fund. Ct = D + nCr, where Ct = cost of total capital additions, D = debt, n = number of years for construction program, and Cr = improvements paid for from annual revenues. K2 is a function of fc and the payments to the reserve fund on existing obligations, and DSc is the maximum annual debt service on al existing debt. The cash coverage factor and number of years required for construction completion exert a greater influence on the optimum amount of debt than do interest rates. (Cassar-FRC)
W83-01055

CREATIVE FINANCING TECHNIQUES FOR WATER UTILITIES,

John Nuveen and Co., Inc., Chicago, IL.
P. C. Williams.
Journal of the American Water Works Association, Vol 74, No 9, p 443-449, September, 1982. 1 Fig, 5 Tab, 2 Ref.

Descriptors: *Financing, *Economic aspects, *Bond issues, *Utilities, Capital costs, Debt, Interest rates, Insurance, Investment, Loans, Planning.

Contemporary methods for financing water utility capital expansions and improvements are reviewed. In recent years the bond market has become increasingly volatile. Individuals and families are becoming a more important force in the bond market as investments by banks and insurance companies have declined. Negotiated bond sales have increased from 33% to 75% of total volume in the past 5 years. Some creative or innovative interim financing methods (short-term or temporary) include bond anticipation notes (maturing in 1-3 years and payable solely from the proceeds of a long-term bond issue), secured bond anticipation notes, direct bank loans (at rates 60-85% of the bank's prime lending rate), commercial paper (15-45 days maturity), and variable rate demand notes (maturity 2-3 years with weekly fluctuating interest rates). A table summarizes payment source, additional security, maturity, interest rates, other costs, and advantages and disadvantages of each interim financing technique. Some longterm bond financing alternatives are tender option bonds (put bonds), which are usually limited to 10-25% of the total bond issue; floating rate bonds, in which interest varies with the market; tender option bonds with adjustable rates; municipal bond insurance, often saving 1/4 to 3/8 of 1% in interest over 20-25 years; original issue discounts, a long-standing provision increasingly used by municipalities; zero coupon bonds, sold at 3-20% of par value in return for no interest; stepped coupon bonds, with interest rates increasing each year, perhaps from 8% the first year to 20% or more in the 25th year; and bonds with warrants attached (options to buy an additional bond at the same rate within 1 year). To suit the needs of investors, some municipalities offer their bond issues in several packages with different types of financing. (Cassar-FRC)
W83-01056

THE ROLE OF INVESTMENT BANKING FIRMS IN MANAGING WATER PROJECT FINANCING,

Lehman Bros. Kuhn Loeb, Inc., NY.
F. C. Starr, and R. W. Forbes.
Journal of the American Water Works Association, Vol 74, No 9, p 451-455, September, 1982. 3 Tab.

Descriptors: *Financing, *Economic aspects, *Investment, *Utilities, Bond issues, Debt, Planning.

The primary business of an investment bank is to assist its clients in establishing and implementing a financing strategy. The current volatile bond market and uncertain economic conditions have made investment services a decisive market and uncertain economic conditions have made investment services a decisive factor in maintaining fiscally sound water services. The main functions of an investment banker, who is not a banker but a financial intermediary, are financial advice and counsel, risk-bearing services (i.e., underwriting), and distribution of securities through a marketing staff. The history of a typical new bond issue is followed through preunderwriting conferences, activities of the underwriting syndicate, offering and sale of the securities, and stabilizing the price of the issue. The two common methods of underwriting in the tax-exempt bond market are negotiated sales and competitive bidding. Each has its advantages and disadvantages. During the past 10 years the volume of negotiated sales has increased from 28% to 61% of municipal financing. There has been renewed emphasis on strategic financial planning which must begin in the earliest stages of project evaluation. After a bond sale, investment bankers can continue in an advisory role. Post-sale activities include developing strategies for managing sinking fund retirements, assisting in reviews for possible bond rating upgrading, and providing related financial services such as investments for cash management purposes. (Cassar-FRC)
W83-01081

AN ECONOMIC EVALUATION OF INTERBASIN WATER TRANSFERS: A CASE STUDY OF SOUTHWESTERN CONNECTICUT,

Connecticut Univ., Storrs. Insti. of Water Resources.
L. R. Fattarusso Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139907, Price codes: A06 in paper copy, A01 in microfiche. M. S. Thesis, 1982. 108 p, 4 Fig, 7 Tab, 54 Ref, 2 Append. OWRT A-086-CONN(2).

Descriptors: *Interbasin transfers, *Water allocation, *Cost analysis, *Model studies, *Water requirements, *Water supply, Connecticut, Water transfer, Economic aspects.

In 1980, a survey of southwestern Connecticut's major water companies was initiated to obtain information regarding water requirements and supply estimates and cost informatin. An economic analysis of te water supply problem facing the region (Fairfield County and the town of New Milford) was undertaken to determine optimal water allocation for the study area. Supply and water requirements estimates were obtained for 1979, and these estimates were projected for the years 1985 and 2000. Ninty-four water supply sources (both existing and proposed), 23 requirement areas and all potentially feasible water supply schemes were identified. A linear programming model of the transportation type was developed to determine the optimal regional water allocation scheme. The least cost method of supplying southwestern Connecticut with potable water to meet its water requirements was determined for the years 1979, 1985, and 2000. It was found that the total cost of supplying water can be reduced by using an optimization model to plan water allocations on a regional basis. By the year 2000 even under the most conservation water requirement scenario there will be a water deficit in southwestern Connecticut unless proposed water sources are developed. (Moore-SRC)
W83-01271

A PRICING POLICY FOR GROUNDWATER MANAGEMENT IN PUERTO RICO,

Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
R. Ramgolam, and R. A. Rios.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139980, Price codes: A04 in paper copy, A01 in microfiche. Report, February 1982, 56 p, 5 Fig, 7 Tab, 21 Ref, 1 Append. OWRT A-055-PR(1).

Descriptors: *Pricing, *Pumping, *Groundwater management, *Mathematical models, *Puerto

Rico, Economic aspects, Groundwater depletion, Water users, Cost analysis, Energy.

The effect of irrational withdrawals of groundwater is being felt throughout Puerto Rico, particularly in areas where the quatity demanded is approaching or already exceeds the quantity supplied. The aim of this study is directed towards the internalization of external costs which fall upon estabiliched water users through the pumping of ground water from a common-pool by new water users. It is rationalized that these external costs to established users manifest themselves in additional pumping costs which are reflected primarily in incurrence of added energy costs. The determination of these costs which constitutes the basis of a price levied on new users and consequent compensation to established users was achieved through the development of a mathematical model. Through this model it is shown that: the greater the quantity of water extracted by new users, pumping (additional) costs were higher for established users; the greater the distance between two wells, the additional pumping costs were correspondingly less for established users; and when the distance is greater than the radius of influence (3,500 ft) no additional pumping costs were incurred. (Moore-SRC)
W83-01276

SETTING EQUITABLE WATER RATES,
Black and Veatch, Kansas City, MO.
C. W. Keller.
Consulting Engineer (St. Joseph), Vol 59, No 3, p 96-102, September, 1982. 4 Tab.

Descriptors: *Water rates, *Pricing, *Water use, Water supply, Water demand, Planning, Water metering.

At present most water rates are based on a monetary charge per unit of volume, that is, a certain number of cents per thousand gallons or hundred cubic feet, with or without a decline or increase in the charge as water consumption increases in the billing period. In early American water utility practice water use was not measured by meter. There are three basic steps in water rate determination. The first is to determine revenue requirements, or the total annual amount the utility must derive from rates. The second step is to allocate cost to the various customer classes such as residential, commercial, and industrial. The third step is the actual design of rates so that the cost can be recovered and the utility receives the total revenue it needs. Recent developments include consideration of marginal cost pricing, sociological pricing, time differential pricing, pricing to conserve water use including inverted rate schedules, and substantial connection fees for new customers. (Baker-FRC)
W83-01330

COSTS OF PREVENTIVE MAINTENANCE PROGRAMS IN WASTEWATER COLLECTION SYSTEMS,
Burns and Roe Industrial Services Corp., Paramus, NJ.
For primary bibliographic entry see Field 5D.
W83-01339

EXPANSION PLANNING OF WATER SUPPLY PROJECTS IN TEGUCIGALPA, HONDURAS (AUSBAUPLANUNG VON WASSERVERSORGUNGSPROJEKTEN IN TEGUCIGALPA, HONDURAS),
Lahmeyer International G.m.b.H., Frankfurt am Main (Germany, F.R.).
For primary bibliographic entry see Field 6A.
W83-01343

6D. Water Demand

EFFICIENCY OF RESOURCE USE UNDER SMALL-SCALE IRRIGATION TECHNOLOGY IN NIGERIA,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W83-01083

WOOD AND WATER,
K. Johnston.
Soil and Water, Vol 17, No 2, p 7-9, April, 1981.

Descriptors: *Forestry, *Water resources development, *Hydrology, Water supply, Water demand, Available water, Water level, Forest watersheds, Erosion control, Forest management, Clearcutting, Forest hydrology, *New Zealand.

New Zealand is expected to see a massive increase in its forestry industry, with a seven-fold increase in forestry exports and another one million hectares planted in exotic forests after the turn of the century. Doubling the area of forests will have a great impact on local soils and hydrology. What will be done with these new trees and those already planted is a telling question for New Zealand's water resources. How the trees will be tended during their first decade of life will determine how much clearwood is available for structural timber or how much is good for only pulping, panels or energy production. The choices made will have a great impact on the development of the industry and of the demands made for water. One major question is whether there is enough water available to meet the demands of pulp mills and still continue to meet other industrial, agricultural, recreational, wildlife and fisheries needs. Recycling of water was advanced as a potential solution to part of the problem. The effects of afforestation on soil stability differ significantly from site to site. It is noted that burning and clearing pre-existing vegetation prior to planting substantially increases the water yield for two to three years. Destocking of pasture to permit planting decreases water yield. Growth of forests results in decreases in annual water yield lower-quartile flow, flood peaks and storm runoff. Groundwater levels rise following thinning or clearfelling. An equation is given for estimating the increase in annual water yield following harvesting of a forest, knowing the annual rainfall. (Baker-FRC)
W83-01171

WATER TO PLAY WITH,
Taranaki Catchment Commission (New Zealand).
J. Hutchings.
Soil and Water, Vol 17, No 2, p 4-6, April, 1981. 3 Fig.

Descriptors: *Recreation demand, *Water resources development, *Planning, Water use, Water demand, Recreation facilities, Fishing, Diving, Swimming, *New Zealand, North Taranaki.

The growth in competition between industrial, residential, agricultural, and recreational water demands has heightened the need for water resource planning in North Taranaki. In such planning, it is difficult to establish the needs of the recreational user. Recreation implies a recognition of esthetic rather than economic values and an appreciation of the qualitative aspects of life as opposed to the quantitative. Offshore, coastal and river waters available for recreational use were evaluated by selecting certain criteria considered relevant in contributing to the attractiveness of the resource to the population and important in affecting the choice of any recreational water resource used. A number of recommendations resulted from this assessment of recreational use of water. Coastal waters and areas provide ample opportunities for fishing, diving, and swimming. The Waitara River scored poorly in terms of its scenic appeal, but the range of activities and the unique nature of the river for particular activities resulted in its being ranked the most important recreational river resource in the area. (Baker-FRC)
W83-01172

MODERNIZING IRRIGATION SYSTEMS IN ALBERTA,
Department of the Environment, Edmonton (Alberta). Div. of Design and Construction.
For primary bibliographic entry see Field 4A.
W83-01232

AN ECONOMIC EVALUATION OF INTERBASIN WATER TRANSFERS: A CASE STUDY OF SOUTHWESTERN CONNECTICUT,
Connecticut Univ., Storrs. Insti. of Water Resources.
For primary bibliographic entry see Field 6C.
W83-01271

WATER DEMAND ON THE RAKAIA,
D. Leather.
Soil and Water, Vol. 16, No. 3, p 17-21, June, 1980. 2 Fig.

Descriptors: Water resources development, *Planning, Computers, Model studies, Irrigation projects, Rakaia River, Fisheries, Fish, *Water demand, *New Zealand.

A recent report on water use and irrigation development on the Rakaia River (New Zealand) is discussed, with emphasis on the issues which arise over the potential exploitation of the Rakaia. Of all the Canterbury rivers, the Rakaia provides the greatest water resource, with a mean annual flow of 196 cubic meters per second at the Rakaia Gorge. There are 21 species of fish found in the Rakaia River. An irrigation demand assessment study was carried out for the Central Plains and Lower Rakaia Schemes. Using a computer model, soil moisture levels were simulated and irrigations applied where needed. Estimates of average demand and demand peaks were made for the 11 irrigation seasons and for 7 different crops on 5 different soil types. Regardless of what level of development occurs on the Rakaia, there is a need for information on its fisheries and wildlife resources. Through use of the Incremental Method basic information is obtained from specific point transects at representative sites across which the investigative team traps extensively for fish and samples for invertebrates. Further hydrological information will also be collected. If the Lower Rakaia Scheme is developed, it is hoped that it will be sufficiently flexible to allow reduced abstractions for periods of two or three weeks during times of critical flows in the river. (Baker-FRC)
W83-01315

PLANNING FOR DROUGHTS,
Metcalf and Eddy, Inc., Boston, MA.
L. A. Edmonds, and S. L. Bishop.
Consulting Engineer (St. Joseph), Vol 59, No 3, p 90-94, September, 1982. 1 Fig, 1 Tab.

Descriptors: *Droughts, *Water supply, *Planning, Water resources development, Drinking water, Water stress, Gloucester, Rockport, *Massachusetts, Water conservation, Conservation, Water management, Management.

To avoid adverse impacts, communities and water authorities must plan for droughts. Such planning has two basic concepts: first, using various means of decreasing or suppressing water use, and secondly, tapping emergency sources of water supply. Several actions every water purveyor should consider are: to obtain and keep up-to-date information on existing water supplies and water usage; reduce unnecessary losses from the system; develop an emergency drought management program, identifying how demand may be forcibly reduced, as needed, by applying water use restrictions; identify and evaluate emergency sources of water supply; develop a water conservation program that includes an active citizen education element; manage water supplies intelligently to optimize all existing sources; and review water rate structures to verify that they are equitable, adequate, and promote conservation. Water plans of the cities of Gloucester and Rockport, Massachusetts, are reviewed. (Baker-FRC)
W83-01347

6E. Water Law and Institutions

LEGAL ISSUES IN IMPLEMENTING WATER REUSE IN CALIFORNIA,
California Univ., Berkeley.
E. C. Brown, and N. Weinstock.

Ecology Law Quarterly, Vol 9, No 2, p 243-294, 1981. 1 Fig, 1 Tab, 361 Ref.

Descriptors: *Water reuse, *Legal aspects, *Water supply development, *Wastewater renovation, Public health, Water resources development, *California, Financial aspects, Torts, Liability.

Several obstacles to wastewater reclamation which may hinder expanded use of reclaimed water are discussed. Wastewater reclamation technology and the possible uses of reclaimed water are reviewed. The California State agencies that regulate water reuse and the problems they face in promoting reclamation are considered. The need to make reclaimed water cost-competitive with virgin water and the current limitations on government funding for reclamation projects are considered. Two sections on legal issues critical to water reuse in California are included. The first evaluates the impact of California water law on reclamation efforts, and the second discusses the health risks posed by water reuse and the potential application of tort liability theories to injuries caused through the use of reclaimed water. (Baker-FRC)
W83-01074

WATER REGULATIONS,
League of Nebraska Municipalities, Lincoln.
G. Wolverton.
Current Municipal Problems, Vol. 7, No. 3, p 324-326, Winter, 1981.

Descriptors: *Water use, *Regulations, *Water distribution, Water supply, Water demand, Legislation, Federal jurisdiction, Local governments, State jurisdictin, Legal aspects.

Eleven types of regulations that may affect water distribution operations have been defined, seven of which bring about federal statutory control. These are the Safe Drinking Act (SDWA), Clean Water Act (CWA), Clean Air Act (CAA), Resource Conservation and Recovery Act (RCRA), Hazardous Materials Transportation Act (HMTA), Occupational Safety and Health Act (OSHA), and the National Energy Conservation Policy Act (NECPA). The other four types of regulations are basically state and local controls and may have wide variations from place to place. These are Public Utilities Acts, Water Supply Statutes, Environmental Satutes and Water Supply Agreements. The SDWA directs the EPA to set and enforce national regulations restricting the concentrations of contaminants in the drinking water. The CWA has two sections which may impinge on use of reclaimed water and distribution systems. The CAA affects water supply operations indirectly by requiring vehicles to have proper pollution control devices. RCRA treats the disposal of sludge in water treatment plants as well as waste oil from garages and pumping plants. HMTA calls for registering and directing the transportation of hazardous materials. NECPA could become a regulator under the energy conservation regulations now being written. The Public Utilities Commissions have a broad spectrum of control over financing, rates and operation. Environmental Statutes impose their rules on water distribution systems operating under some type of federal authority. Water supply agreements usually impose regulations only on member agencies. (Baker-FRC)
W83-01144

FEDERAL COMMON LAW AND ITS APPLICATION TO DISPUTES INVOLVING ACCRETIVE AND AVULSIVE CHANGES IN THE BOUNDS OF NAVIGABLE WATERS,
Quarles and Brady, Milwaukee, WI.
J. C. Cabaniss.
Land and Water Law Review, Vol 17, No 2, p 329-365, 1982. 182 footnotes.

Descriptors: *Riparian rights, *Boundary disputes, *Water rights, *Legal aspects, *Water law, Property rights, Judicial decisions, Federal jurisdiction, State jurisdiction, Common law, Accretion, Avulsion, Navigable waters, Constitutional law, Jurisdiction, Property boundaries, Public lands, Legislation, Interstate rivers.

The choice of law rules that affect riparian rights following changes in water boundaries due to accretion or avulsion is explained. Two alternatives are federal common law and state law. The current state of the law in each area and the proper choice of law for establishing the initial boundary of a federal patent are discussed. Also addressed are the problems of riparian rights in cases of property owned prestatehood and accreted or avulsed after statehood, what federal interests are present in determining the type and scope of title acquired by public land states on admission to statehood under the equal footing doctrine, and the choice of law rule for locating an interstate boundary affected by accretion or avulsion. Several inconsistent Supreme Court decisions are discussed. It is suggested that the federal protection of riparian rights should be based on the 5th and 14th amendments, which prohibit taking property without just compensation. (Cassar-FRC)
W83-01160

GOVERNMENT ANNOUNCES POLICY ON WILD RIVERS,
D. Leather.
Soil and Water, Vol 16, No 1, p 22-23, February, 1980.

Descriptors: *Rivers, *Recreation, *Policy making, Regulations, Political aspects, Administrative decisions, Public policy, Political constraints, Legal aspects, *New Zealand.

A new policy concerning wild and scenic rivers was announced by the New Zealand government in November of 1981. The policy statement declared that rivers or sections thereof that have outstanding wild, scenic or other natural characteristics should be protected. Existing legislation will have to be strengthened with statutory provisions. Recreational users should be given the same opportunity to apply for the protection of a river as other river users have to protect their use by obtaining water rights. The Canoeing Association has been the most vociferous lobby group in the wild and scenic rivers debate thus far, and it has been the only group to comment publicly on the policy statement. (Baker-FRC)
W83-01164

THE NATIONAL DEVELOPMENT ACT AND REGIONAL WATER BOARDS,
E. J. Hudson.
Soil and Water, Vol 16, No 2, p 4-5, April, 1980.

Descriptors: *Water resources development, *Regulations, *Legal aspects, Water development, Water supply, Water quality, Political aspects, National Development Act, *New Zealand.

The National Development Act became law in New Zealand in December of 1979. The aim of the Act is to provide for prompt consideration and obtainment of statutory consents for proposed works of national importance. The effect of the Act is to increase significantly the power of the executive. The Act will have several effects on water boards. A regional water board is bound to observe the principles of the Water and Soil Conservation Act of 1967 as pertains to the conservation, allocation, use and quality of natural water; the promotion and controlling of multiple uses of natural water; and the needs of primary and secondary industry, fisheries and wildlife habitat. Another effect on regional water boards is that under the Act a board can be required to investigate an application and make a report with recommendations to the Tribunal. However, there is no provision as to who should bear the cost of such an investigation. A third major effect of the Act is the time limit imposed upon a water board for investigation of applications and recommendations pursuant to Section 6 of the Act. The 4.5 months allowed for investigation of an application and making of a report may in many cases be insufficient. In spite of its shortcominga, the Act is here to stay, and regional water boards will have to learn to work within its confines. (Baker-FRC)
W83-01167

A WATER RIGHT FOR FISHERIES,
Wellington Acclimatisation Society (New Zealand).
N. Watson.
Soil and Water, Vol 16, No 3, p 14-16, June, 1980. 1 Fig.

Descriptors: *Water rights, *Fisheries management, Water quality, Water demand, Fish, Legislation, Fisheries, *New Zealand.

The responsibility for managing New Zealand's freshwater fisheries belongs to the Acclimatisation Societies under a statutory arrangement. Management of fisheries now involves the protection of rivers and existing trout habitats from harmful developments. Thus the Wellington Acclimatisation Society applied to the Manawatu Catchment Board for a water right to use for the maintenance of a trout fishery those waters of the Manawatu Catchment District which fall in the Wellington Acclimatisation Society district. The key question in the appliation is whether the acclimatisation society is legitimately using natural water for the maintenance of a trout fishery. Indeed, in the Manawatu catchment the water is being actively used for the specific purpose of protecting, maintaining and improving the stocks of trout to provide recreation. By granting the water right to the society the Catchment Board has accepted the challenge of recognizing under the law the usage of water for sports fisheries. (Baker-FRC)
W83-01293

SUPREME COURT ISSUES GROUNDWATER RIGHTS RULING,
K. McCray.
Water Well Journal, Vol 36, No 9, p 53-54, September, 1982.

Descriptors: *Water rights, *Legal aspects, *Groundwater, Water resources development, Water supply, Supreme Court, Regulations, Nebraska, State Jurisdiction, Water supply development.

A recent ruling of the Supreme Court based on the Constitution's commerce clause jeopardizes laws in 13 Western states that ban or limit out of state groundwater resource use. Seventeen states had filed briefs supporting Nebraska's contention that states have the right to regulate internal groundwater use. The ruling still allows the states to have significant power under other provisions to control out of state water shipments. Congress may now be forced to nationally protect groundwater in the light of the Supreme Court's Nebraska ruling. The Court said that the existence of 37 statutes and several interstate compacts demonstrating Congressional deference to state water law has not granted the states permission to engage in groundwater regulation outside of existing constitutional restraints. Only where Congress' intent and policy to sustain state legislation from attack under the commerce clause is expressly stated are such restraints legal. (Baker-FRC)
W83-01337

6F. Nonstructural Alternatives

PREVENTING EROSION, LANDSLIP AND FLOODING, A PLANNING APPROACH,
Ministry of Works and Development (New Zealand).
J. Lawrence.
Soil and Water, Vol. 16, No. 1, p 19-21, February, 1980.

Descriptors: *Water resources development, *Plannng, *Erosion control, Urban planning, Drainage, Urban drainage, Reginal development, Flooding, *Australia, New South Wales.

A general awareness has arisen in New South Wales (Australia) that soil erosion and flooding can be avoided by considering physical hazards before zoning and subdivision take place for urban development. An urban capability map is derived for an area under study from an assessment of the interaction of physical features on the site. Relevant climatic data is presented, along with landlform, ge-

ology, soils and drainage information. A soil mapper then carries out a soil survey of the site, using landform boundaries to indicate soil unit changes, and confirms these with laboratory analysis of engineering properties and erodibility as well as information on soil drainage and depth to bedrock. All this information about the site is used to prepare an urban capability map, depicting a number of classes, sub-classes and a recommended capability for each class. A number of sub-classes are defined to indicate the dominate physical limitations which restrict development. As well as providing capability surveys for local councils, the Soil Conservation Service gives site-specific advice while subdivision and building activities are proceding and where problems arise in areas already developed. (Baker-FRC)
W83-01147

6G. Ecologic Impact Of Water Development

SIMULATING THE LATERAL TRANSPORT OF ICHTHYOPLANKTON IN THE POTOMAC ESTUARY,
Maryland Univ., Solomons, Center for Environmental and Estuarine Studies.
For primary bibliographic entry see Field 2L.
W83-01136

OHIWA HARBOUR, NATURAL VALUES,
Ministry of Agriculture and Fisheries Auckland (New Zealand). Fisheries Management Div.
J. Akroyd, and A. Kilner.
Soil and Water, Vol. 16, No. 2, p 18-21, April, 1980, 1 Fig.

Descriptors: *Water resources development, *Estuaries, *Environmental effects, Water quality, Harbors, Recreation, Ohiwa Harbor, *New Zealand.

Ohiwa Harbour is a shallow tidal estuary lying in the eastern Bay of Plenty (New Zealand). The surrounding country is rolling farm land, with a few areas of bush. Intertidal zones are extensive in area and gently shelved, with the greatest width occurring in the mid-tidal zone. Plant life is luxuriant and diverse, largely due to shallowness of the water, which allows light penetration, shelter and nutrient input. The harbor is close to a number of urban centers and offers opportunity for many activities. The greatest threat is the common attitude that an estuary represents unused space to be developed. Other threats accrue indirectly from activities occurring within the watershed. Stopbanking, drainage, infilling and fencing off of parts of the estuary in attempts to increase agricultural production can have serious effects on the ecosystem. (Baker-FRC)
W83-01146

A RIVER STUDY,
For primary bibliographic entry see Field 5G.
W83-01150

THE EFFECTS OF MINING SOUTHLAND LIGNITE ON WATER AND SOIL RESOURCES,
Southland Catchment and Regional Water Board (New Zealand).
W. J. Tuckey, and L. R. McKenzie.
Soil and Water, Vol 16, No 1, p 2-6, February, 1980. 1 Fig.

Descriptors: *Environmental effects, *Mining engineering, *Water quality, Water supply, Coal mining, Water demand, Water use, Recreation demand, Agriculture, Industrial water, *New Zealand, Mataura Valley, Southland.

A proposal has been made to turn lignite coal from Southland (New Zealand) into liquid fuel. Implications of such proposals for the soil and water resources of Southland are commented upon in this article. About 85% of the available lignite in the Mataura Valley occurs in six deposits, covered by a wide range of landforms and soil types, so large-scale lignite mining would have a varied environmental effect both during and after extraction. The deposits underlie some of the most versatile soils in Southland, some of which are valuable as food production soils. A major problem is the effect of drainage both on and off site. Restoration and subsequent drainage of rolling country is not viewed as too great a problem. However, extraction from the several flat low-lying areas could be ruled out due to the lack of height of the land above sea-level and the resultant effect on the water table. A number of water users already have large claims on the available surface water and groundwater for industrial processing and waste disposal. In the southern lignite deposits, mining would be carried out below sea level, and the dewatering of opencast areas has led to concern that possible salt water intrusion might ruin existing groundwater supplies. The operation of opencast mines will have both on-site and off-site effects on water qualithy and quantity, not only for industrial but for agricultural and recreational users as well. (Baker-FRC)
W83-01151

ASWAN - DAM AND BE DAMNED.
For primary bibliographic entry see Field 4A.
W83-01156

MAHURANGI, PROBLEMS OF MANAGEMENT,
Rodney County Council (New Zealand).
M. Elliot.
Soil and Water, Vol 16, No 2, p 26-28, April, 1980. 2 Fig.

Descriptors: *Water resources development, *Environmental effects, *Water management, Mahurangi Harbor, *New Zealand, Harbors.

The Mahurangi Harbour (New Zealand) is extensively shoaled. Its intertidal foreshores tend to be wide and soft. Water quality monitoring has shown the harbor to be essentially pollution free. There are few points for public access to the harbor, and these do not lend themselves to significant expansion. Residential settlement is also limited. The catchment area of the harbor is small and contains mainly pastoral farms with some timber growing. Issues to be considered in planning for development of the Mahurangi harbor and catchment include protecting existing oyster farming industry from environmental change, preventing oyster farming from expanding to the detriment of other harbor values, and balancing recreational, aquaculture and environmental values. (Baker-FRC)
W83-01168

MANGANUI-A-TE-AO: THE TUG OF WAR RIVER.
Soil and Water, Vol 17, No 1, p 20-22, February, 1981. 1 Fig.

Descriptors: Rivers, *Water resources development, *Planning, Fisheries, Powerplants, Water quality, Regulations, Legal aspects, *New Zealand, Environment effects, Manganui-a-te-Ao River.

The Manganui-a-te-Ao River in New Zealand is becoming a test case for decision, as it is both well suited for the development of a small hydro scheme and a prime candidate for preservation in its unmodified natural state. The river and its tributaries rise on the western slopes of Mt. Ruapehu, flow through the Eura State Forest, through farmland near Raetihi and into the Waganui River above Pipiriki. Three power schemes can be conveniently located on the river using a system of dams and tunnels to obtain generating head. While the Power Board was preparing its plans, the Ministry of Environment along with the Minister of Works and Development said that the Government had approved policy that would ensure the protection of rivers or sections of rivers with outstanding wild, scenic or other natural characteristics. One possible avenue to explore is the provision in the Water and Soil Conservation Act which enables the National Authority to fix a minimum acceptable flow for any river or stream. The ultimate future of the Manganui-a-te-Ao River will be primarily affected by a judgment on whether the claim of the Power Board that both a hydro development and a fishery can co-exist can be substantiated. (Baker-FRC)
W83-01174

SOME OBSERVATIONS ON THE ECOLOGY AND FISH MANAGEMENT OF RESERVOIRS IN THE UNITED STATES,
Fish and Wildlife Service, Slidell, LA.
N. G. Benson.
Canadian Water Resources Journal, Vol 7, No 1, p 2-25, 1982. 5 Fig, 1 Tab, 30 Ref.

Descriptors: *Reservoirs, *Fisheries, *Fish management, Reservoir fisheries, Ecosystems, Ecology, Fish, Plankton, Nutrients, Fish populations, Vegetation.

In the United States by the year 1980 there were 1608 reservoirs with a surface area of 4 million ha. Due to a lack of suitable sites and the opposition of environmental interests, construction of new reservoirs has decreased in recent years. Reservoirs have characteristics of both lacustrine and riverine ecosystems. For simulation model studies reservoirs have been segmented into riverine, transitional and lacustrine zones. Fish and plankton production increases rapidly after initial impoundment and then decreases and stabilizes at lower levels. Decreases in the number of fish species and in fish biomass following impoundment are caused by reduced quantity and quality of spawning and nursery habitat and decreased detrital input. The most effective fish management programs have included introduction of new fishes, developing vegetation or building structures on the reservoir bottom. Considerable progress has been made in predicting the effects of environmental parameters on fish production. Many of the important controlling parameters are beyond the control of the fishery manager for long term management, as they were set when the reservoir was built. Future fish management at reservoirs should be directed toward developing a better understanding of those ecological factors that can be controlled after the reservoirs are constructed. (Baker-FRC)
W83-01225

PATH ANALYSIS OF A RESERVOIR ECOSYSTEM MODEL,
Georgia Univ., Athens. Inst. of Ecology.
B. C. Patten, T. H. Richardson, and M. C. Barber.
Canadian Water Resources Journal, Vol. 7, No. 1, p 252-282, 1982. 6 Tab, 9 Ref.

Descriptors: *Reservoirs, *Ecosystems, *Path analysis, Lakes, Lake Texoma, *Texas, *Oklahoma, Mathematical equations, Model studies.

A path analysis of a static ecosystem model for a cove in Lake Texoma, Texas-Oklahoma, was performed based on algebraic manipulations of the adjacency matrix and a corresponding Markov one-step transition matrix. The analysis revealed that overwhelming predominance of indirect or direct effects occurred. Very long path lengths were required to approach total effects. Self-effects of compartments diminished with increasing path lengths. Interaction effects between compartments initially increased and then decreased with increasing path length. Each compartment's structural and functional relationship within the model could be characterized in terms of numbers of incoming and outgoing paths of different lengths and influences associated and rates of change of structural and functional input-output coupling with increasing path length and whether they are net producers or consumers of influence in the system network. (Baker-FRC)
W83-01228

SIMULATION OF FISH MOVEMENTS IN A LARGE HYDRO-ELECTRIC RESERVOIR: LG-2,
Sherbrooke Univ. (Quebec). Faculte des Sciences Appliquees.
K. Morrison, and N. Therien.
Canadian Water Resources Journal, Vol. 7, No. 1, p 416-429, 1982. 7 Fig, 5 Ref.

Descriptors: *Reservoirs, *Fish, *Environmental effects, Habitats, Flooding, Model studies, Fish populations.

To examine the utilization of new habitats by fish, as would occur in reservoir flooding, a two-dimensional model was made of fish movements in the LG-2 reservoir. The model can take into account the effects of several factors on fish movements. While many researchers have studied swimming speeds in laboratories, such results are not applicable for obtaining displacement speeds in a natural system. Therefore, Monte-Carlo simulations based on fish tracking studies have been used to estimate net displacements per unit time for individual fish. This information has been used to give a time frame to the full-reservoir model. The first use of the model was to examine the dispersion of fish into the reservoir in the first year. Examinations have been done for the major species found in the area. Results are compared to catch-per-unit-effort data collected the year after flooding. The model gives relative densities of fish at grid points in the reservoir over time. The results of the model have implications as to the interpretation of fish data collected after impoundment. (Baker-FRC)
W83-01229

LIMNOLOGY OF MT. ELBERT FOREBAY 1978-79,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 2H.
W83-01268

THE DYING ESTUARY,
P. Gregory.
Soil and Water, Vol 17, No 2, p 18-19, April, 1981. 1 Fig.

Descriptors: *Estuaries, *Environmental effects, Water resources development, Estuarine environment, Sand, Land reclamation, Fishing, Silt, *Silting, Sedimentation, Seawater, *New Zealand, Maketu Estuary, Wetlands.

The Maketu Estuary is one of New Zealand's endangered wetlands. Sand is strangling this estuary; the mussel beds have disappeared. It is anticipated that a storm could close the outlet altogether and the sea could then overtop the low-lying sandy spit now dividing the estuary from the ocean and flood the lagoon with salt water, which would flow onto adjacent farmland. These problems began to develop in 1956, when the Kaituna River was diverted at Te Tumu to flow through 'The Cut' at the farthest end of the bar from Maketu township. The long term effects of this diversion were not carefully considered. This deversion, plus the 1974 blocking of a causway, has caused the present situation. A proposed comprehensive catchment control scheme is in the works which will cost about $20,000. Two options are being considered: First, to construct and maintain a stable outlet from the estuary to the sea, and secondly, to abandon the sea outlet, allow natural deterioration to continue, and provide for discharge of drainage of the estuary catchment into the Kaituna River. (Baker-FRC)
W83-01291

MORE OR LESS WATER,
Friends of the Earth, Nelson (New Zealand).
D. Shaw.
Soil and Water, Vol. 17, No. 2, p 20-21, April, 1981.

Descriptors: *Water supply development, *Dam construction, *Environmental effects, Floods, Earthquakes, Water quality, Nelson, *New Zealand, Waimea estuary, Estuaries, Water resources management, Earth dams.

Two aspects of water use in the Nelson City area are examined. The present water supply system is estimated to be able to supply about 22,000 cubic meters of water per day during low rainfall periods in the summer. Water usage reaches an estimated summer peak of 34,000 cubic meters per day, resulting in the need for restrictions on domestic water use. Possible schemes have been examined to augment the water supply. A 36 meter high earth-fill dam on the north branch of the Maitai River was the preferred approach. Rate-payers will be faced with considerable rate increases over the next few years to pay for the dam construction, loan servicing and the almost inevitable cost overruns. However, a study also indicated that water conservation measures aimed at making more efficient use of the water consumed at present could make a very significant impact on reducing water consumption, and perhaps the need for such a large and expensive dam would also be reduced. Various conservation measures could be encouraged, which would also reduce water usage. The poor water quality currently experienced by Nelson residents would not necessarily be improved by the dam construction. There is also a fear of significant destruction should the dam crack under earthquake or flood conditions. Another concern is for the Waimea Estuary, which will be significantly altered should dam construction proceed. (Baker-FRC)
W83-01317

CUBA'S ZAPATA PROJECT,
T. W. Saenz, and T. Lang.
Ambio, Vol 11, No 4, p 231-234, 1982. 1 Fig, 4 Tab, 4 Ref.

Descriptors: *Environmental effects, Water resources development, Swamps, *Zapata Swamp, Gulf of Batabano, Ecosystems, *Cuba.

The Zapata Project is part of a larger investigation into the ecological evaluation of the influence of use of pesticides and fertilizers on aquatic and terrestrial ecosystems. The socio-economic development of the Zapata Swamp area involves the widespread application of pesticides and fertilizers in the citrus, rice and sugar cane plantations; the generation of more industrial wastes, mainly from the sugar industry; and an increase in the consumption of surface and groundwater. The first stage of the project is to determine the amount of organic matter and other pollutants from agriculture and industry being discharged into the Swamp and through it to the Gulf of Batabano; to determine characteristics and parameters of the dominant terrestrial and aquatic ecosystems and the role they play in the Zapata Swamp/Gulf of Batabano interface; to make an integrated evaluation of the environmental impacts produced by the social and economic activity in the region; and to make recommendations for the rational use of the region's natural resources, taking into consideration the economic and social aspects involved. Finally the plan will create a technical and scientific infrastructure in the region to facilitate local research activity and provide the basis for the systematic monitoring of the different ecosystems, the environmental impact on them, and the elaboration of appropriate recommendations. (Baker-FRC)
W83-01328

THE SELECTION OF FISHERY PARAMETERS FOR INCLUSION IN THE STREAM REACH INVENTORY AND CHANNEL STABILITY INDEX,
Wyoming Univ., Laramie. Dept. of Agricultural Engineering.
W. H. Eifert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146696, Price codes: A06 in paper copy, A01 in microfiche. M.S. Thesis, May 1982. 122 p, 13 Fig, 15 Tab, 81 Ref, 2 Append. OWRT-A-033-WYO(2).

Descriptors: *Stream banks, *Channels, *Aquatic habitats, *Trout, Watersheds, Fish populations, Standing crops, Habitats, *SRICSI scores.

An ocular watershed evaluation methodology, entitled Stream Reach Inventory and Channel Stability Index (SRICSI), was designed primarily to assess the physical aspects of channel and streambank stability. The SRICSI's value as an aquatic habitat evaluation technique was basically unknown. During the spring and summer of 1981, seventeen representative study sites on two second-order montane streams were evaluated through application of the SRICSI procedure and three aquatic habitat assessment methodologies. Salmonid population estimates were also obtained for each site. Results indicate that a significant relationship exists between SRICSI scores and both trout population estimates, and to two of the three habitat evaluation procedures. All observed correlations were negative, suggesting that as SRICSI scores increase, trout standing crops and habitat condition decreases. Of 63 habitat-related independent variables, 40 also display significant correlation to trout standing crop data. Fifteen variables were selected for possible inclusion in the SRICSI. Inclusion of those variables found compatible with the SRICSI procedure should increase its biological sensitivity, thereby broadening its use in aquatic habitat studies. (Moore-SRC)
W83-01364

7. RESOURCES DATA

7A. Network Design

RAINFALL VARIATION ANALYSIS AND OPTIMIZATION OF GAGING SYSTEMS,
Agricultural Research and Education Center, Belle Glade, FL. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2B.
W83-01202

A MICROPROCESSOR CONTROLLED SYSTEM FOR STORM WATER SAMPLING (EIN MIKROPROZESSOR-GESTEURTES SYSTEM ZUR PROBENNAHME AUS REGENEASSERKANALEN),
Hanover Univ. (Germany, F.R.). Inst. fuer Wasserwirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau.
H-R. Verworn, and O. Paulsen.
Wasserwirtschaft, Vol 72, No 6, p 240-245, 1982. 4 Fig, 2 Ref. English summary.

Descriptors: *Meteorological data collection, *Data processing, *Rainfall, *Storm runoff, *Water sampling, Computers, Automation, Federal Republic of Germany, Gages, Rain gages, Water pollution, Data interpretation.

A microprocessor-controlled system is described that allows the synchronized collection of precipitation and runoff data as well as goal-directed water sampling in relation to these data. In this way the problems of mixed samples and an excessive collection of samples are avoided, and it is possible to analyze the relationships between pollution parameters on the one hand and regional characteristics, rainfall and runoff on the other. The system was located in Hildesheim (Federal Republic of Germany) and consisted of eight water-level gages, three of which were equipped to take samples, connected to a central processing unit (CPU). The advantages of the system were that measurements were not dependent upon a team of technicians being present during a runoff incident, measurements could be taken at several stations simultaneously, and peak runoff could also be measured. The CPU was a PSI 80-M with a 64 K byte memory, control screen, and two floppy disc drives and was equipped with two eight-channel analog/digital converter panels to convert the measurement data between 0 and 10 V into digital values. operation of the measuring system was monitored and controlled by a continuous real-time program. The program collected the data from rainfall and runoff gages, controlled the samplers, printed out announcements and data, and stored data on floppy discs. Two strategies for sampling were used. Strategy A consisted of the collection of as many rainfall-runoff incidents as possible, while strategy B called for samples of incidents with higher runoff only. For a specific incident, strategy B delivered insufficient data; the number of samples taken (7) did not accurately reflect either the pollution in the first part of the wave or the changes in the course of the incident. Strategy A resulted in the collection of 13 samples, all of which were analyzed for 5-day BOD, COD, ammonium, and chloride. Strategy B does, however, leave empty sample bottles in readiness for a

possible larger incieent occurring within a short time span. (Gish-FRC)
W83-01342

TECHNICAL MANUAL FOR GROUNDWATER EXPLORATION IN ARID AND SEMIARID REGIONS USING LANDSAT VISUAL AND DIGITAL ANALYSES,
Greenhorne and O'Mara, Inc., Riverdale, MD.
J. A. Monte, and D. I. Cooper.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146373, Price codes: AO8 in paper copy, AO1 in microfiche. Completion Report, August 1982. 138 p, 33 Fig, 8 Tab, 40 Ref, 2 Append, plus 6 Transparent Overlays. OWRT C-10058-G(1479)(1). 14-34-0001-1479.

Descriptors: *Satellite technology, *Remote sensing, *Groundwater, *Arid lands, *Landsat, *Geohydrology, Exploration, Phreatophytes, Soil moisture, Topography, Terrain analysis, *New Mexico.

A viable addition to traditional methods of identifying exploratory ground water test well sites is the use of visual and digital Landsat remote sensing technology as an investigative technique. Areas of goundwater discharge are easily recognized from Landsat; they provide valuable clues for defining potential groundwater drilling sites. The research coupled computer-assisted digital image analysis, using an albedo transform in a time series mode, to existing visual qualitative investigative techniques of Landsat data, and investigated the value of applying non-traditionally used groundwater terrain indicators, such as phreatophytic vegetation and soil moisture to groundwater exploration. Southwestern New Mexico, with its basin and range topography, comprised the project area that was subjected to research investigations, reconnaissance and ground verification of Lansat imagery. Combined visual and digital analyses resulted in maps that specify sites recommended for drilling. For the visual Landsat analysis, an overlay system was used to interpret the geohydrology of the project area. Two primary and four secondary drilling sites were delineated on the overlay. As a result of visual analysis, groundwater suspect areas selected for potential drilling were reduced from approximately 13,000 sq mi to 40 sq mi. Digital analyses further reduced the areas to individual target sites measuring 1/3 sq mi or less. A tendency toward unusually higher well yields was observed for the target sites than for surrounding areas. (Moore-SRC)
W83-01356

AN OPERATIONAL KEY STATION NETWORK FOR THE SONE CATCHMENT,
Flood Meteorological Office, Patna (India).
K. Prasad.
Mausam, Vol 33, No 1, p 107-112, 1982. 5 Fig, 2 Tab, 2 Ref.

Descriptors: *Network design, *Gaging stations, *Rainfall, Regression analysis, Sone River, *India.

A rainfall gage network design for the Sone River catchment (a tributary of the Ganga River, India) was designed by stepwise multiple regression analysis. This 71259 sq km rectangular-shaped catchment is prone to severe and frequent flooding. Data from the 13 stations in the upper subcatchment and 18 in the lower subcatchment were used for regression analysis (1951-60) and for testing the equations (1961-70). The key station network derived from the analysis consisted of 6 stations in the upper catchment and 7 in the lower catchment. For each subcatchment an additional station was designated to replace any key station not in operation. (Cassar-FRC)
W83-01384

7B. Data Acquisition

COMPARATIVE STUDY AND CALIBRATION OF SENSORS FOR THE MEASUREMENT OF THE LIQUID WATER CONTENT OF CLOUDS WITH SMALL DROPLETS,
Clermont Univ., Aubiere (France).
P. Personne, J. L. Brenguier, J. P. Pinty, and Y. Pointin.
Journal of Applied Meteorology, Vol 21, No 2, p 189-196, February, 1982. 11 Fig, 3 Ref.

Descriptors: *Clouds, *Atmospheric water, *Measuring instruments, Particle size, Forward Scattering Spectrometer Probe, Johnson-Williams probe, Ruskin probe.

Results from three probes used to measure liquid water content of clouds were compared using data produced during the Precipitation Enhancement Project and the West African Monsoon Experiment. The probes were: the Forward Scattering Spectrometer Probe (FSSP) based on measurement of laser light intensity scattered by each droplet, the Johnson-Williams (JW) probe based on the cooling of a hot wire under constant voltage when impacted by droplets, and the Ruskin probe based on the measurement of the attenuation of Lyman alpha radiation by the water vapor obtained after evaporation of droplets and ice crystals on heated grids. There was disagreement between results from the three probes. The FSSP undercounted the droplet concentration when the mean time lapse between successive particles approached 16 microseconds. The JW underestimated the liquid water content of large droplets ($>$ 30 microns). With corrections, accuracies of the FSSP and JW were improved to produce good agreement with the Ruskin probe. (Cassar-FRC)
W83-01091

THE SELECTION OF FISHERY PARAMETERS FOR INCLUSION IN THE STREAM REACH INVENTORY AND CHANNEL STABILITY INDEX,
Wyoming Univ., Laramie. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 6G.
W83-01364

7C. Evaluation, Processing and Publication

WATER RESOURCES DATA, UTAH, WATER YEAR 1981.
Geological Survey, Salt Lake City, Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-120188, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report UT-81-1, 1982. 708 p, 12 Fig, 1 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Utah.

Water resources data for the 1981 water year for Utah consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 274 gaging stations, stage and contents for 19 lakes and reservoirs, water quality for 65 hydrologic stations and 375 wells, miscellaneous temperature measurements and field determinations for 181 stations, and water levels for 36 observation wells. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Utah. (USGS)
W83-01178

WATER RESOURCES DATA, VIRGINIA, WATER YEAR 1981.
Geological Survey, Richmond, VA. Water Resources Div.
Geological Survey Water-Data Report VA-81-1, 1982. 554 p, 6 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Virginia.

Water resources data for the 1981 water year for Virginia consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 211 gaging stations, stage only at 1 gaging station, stage and contents at 10 lakes and reservoirs, water quality at 48 gaging stations and 75 wells, and water levels at 57 observation wells. Also included are data for 64 crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program. Discharge measurements were made at 98 coal-monitoring partial-record stations and at 171 low-flow partial-record stations. Miscellaneous data were collected at 285 measuring sites and 170 water-quality sampling sites. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Virginia. (USGS)
W83-01179

MAP OF WATER TABLE IN SOLOMON RIVER VALLEY, WACONDA LAKE TO SOLOMON, NORTH-CENTRAL KANSAS, MAY 1980,
Geological Survey, Lawrence, KS. Water Resources Div.
T. B. Reed.
Geological Survey Open-File Report 81-334 (WRI), 1981. 1 Sheet, 4 Ref.

Descriptors: *Maps, *Water table, Contours, Wells, Water level, Groundwater, Groundwater movement, Streams, Water supply, *Kansas, Solomon River valley.

A map of the water table in the Solomon River valley from Waconda Lake to Solomon presents current (1980) data on water levels in the unconsolidated deposits. The Solomon River, which originates in western Kansas, flows southeastward from Waconda Lake to its confluence with the Smoky Hill River at Solomon. In the study area, its valley is incised into consolidated rocks that are composed mostly of shale and limestone. The unconsolidated deposits in the valley underlie the flood plain and the terrace. The alluvial deposits generally consist of gravel and sand, grading upward to sand and silt, with clay lenses interbedded throughout. Thickness of the deposits may be as much as 70 feet. Ground water in the unconsolidated deposits is a principal source of supply for domestic, stock, and irrigation use. Water-table contours indicate that ground water moves from the alluvial deposits to the stream. Thus, the Solomon River gains in flow through most of the reach. Water-level measurements for this study were made during the spring of 1980, prior to the irrigation season. (USGS)
W83-01180

MAP OF WATER TABLE IN GRAHAM COUNTY, NORTHWESTERN KANSAS, MARCH 1979,
Geological Survey, Garden City, KS. Water Resources Div.
J. M. Spinazola.
Open-File Report 81-333 (WRI), 1981. 1 sheet, 1 Ref.

Descriptors: *Maps, *Groundwater, *Water table, *Aquifers, Groundwater movement, Wells, Water level, Recharge, *Kansas, Graham County, South Fork Solomon River.

A map of the water table in Graham County provides current (1980) information on water levels in the unconsolidated deposits. Graham County has an area of 900 square miles in northwestern Kansas. The principal source of water for domestic, stock, municipal, and irrigation use if from wells in the shallow unconsolidated deposits.

The aquifers occur chiefly in the Ogallala Formation of Miocene age and in deposits of Quaternary age. Water in the aquifers generally downgradient from west to east. In the Ogallala Formation, water also moves toward the stream valleys that drain the uplands. The altitude of the water table varies seasonally in response to changes in recharge and discharge. Major sources of recharge are subsurface flow from the west, leakage from streams, and infiltration of moisture from precipitation. Discharge includes subsurface flow to the east, transpiration by plants, evaporation from the aquifer where the water table is near the land surface, flow from seeps, and pumpage from wells. The altitude of the water table is based on water-level measurements made during March 1979. (USGS)
W83-01181

PRECIPITATION DATA FOR BURIAL GROUNDS 5 AND 6, OAK RIDGE NATIONAL LABORATORY, TENNESSEE, 1976-1980,
Geological Survey, Knoxville, TN. Water Resources Div.
D. A. Webster, J. S. Beatty, P. M. Benjamin, and W. M. Tranum.
Available from OFSS, USGS Box 25425 Fed. Ctr. Denver, CO 80225. Paper Copy $2.25, Microfiche $3.50. Geological Survey Open-File Report 82-254, 1982. 15 p, 1 Fig, 3 Tab.

Descriptors: *Data collections, *Precipitation, Recharge, Groundwater reservoirs, Water level, Wells, Solid waste disposal, Rain gages, Sites, *Tennessee, Oak Ridge National Laboratory, Burial grounds.

As part of a hydrogeologic investigation, precipitation data were collected at two stations, one each in Burial Grounds 5 and 6 at the Oak Ridge National Laboratory, Tennessee. Daily, monthly, and annual values are reported herein for the period from January 1976 through December 1980. During this period, annual values ranged from about 25 percent above to about 25 percent below the calculated mean of 51.96 inches at Burial Ground 5 and 49.60 inches at Burial Ground 6. (USGS)
W83-01183

WATER-TABLE MAP OF THE SAN JOSE WELL FIELD AND VICINITY, ALBUQUERQUE, NEW MEXICO, SPRING 1981,
Geological Survey, Albuquerque, NM. Water Resources Div.
J. D. Hudson.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Paper copy $1.50, Microfiche $4.00. Geological Survey Open-File Report 82-375, 1982. 4 p, 1 Tab, 1 Ref.

Descriptors: *Water table, *Groundwater, *Water quality, *Groundwater movement, Contours, Water level, Test wells, Water sampling, *New Mexico, Albuquerque, San Jose well field, Rio Grande.

Water samples taken from Albuquerque's San Jose well field during 1980 contained several undesireable organic compounds. An investigation defined the configuration of the water table in the vicinity of these wells. This map shows the direction of ground-water movement and in selecting test wells for water-quality sampling. (USGS)
W83-01184

GROUND-WATER QUALITY AND DATA ON WELLS AND SPRINGS IN PENNSYLVANIA, VOLUME III--DELAWARE RIVER BASIN,
Geological Survey, Harrisburg, PA. Water Resources Div.
H. E. Koester, and D. R. Miller.
OFSS USGS. Box 25425 Fed. Ctr. Denver, CO 80225. Paper copy $14.75, Microfiche $3.50. Geological Survey Open-File Report 81-330, March, 1982. 111 p, 9 Fig, 9 Tab, 2 Ref.

Descriptors: *Groundwater, *Water quality, *Hydrologic data, Wells, Well data, Springs, Aquifers, Water level, Elevation, Water yield, Geohydrologic units, Sites, Chemical analysis, Trace elements, *Pennsylvania, Delaware River basin.

Volume III of the Ground-Water Quality and Data on Wells and Springs in Pennsylvania presents ground-water quality and physical data on about 1,250 wells and springs in the Delaware River basin in Pennsylvania. Locations are shown on site-location maps derived from the hydrologic unit map. Codes showing the geologic age and aquifer are provided. (USGS)
W83-01185

GROUND-WATER QUALITY AND DATA ON WELLS AND SPRINGS IN PENNSYLVANIA, VOLUME II--SUSQUEHANNA AND POTOMAC RIVER BASINS,
Geological Survey, Harrisburg, PA. Water Resources Div.
H. E. Koester, and D. R. Miller.
Available from OFSS, USGS. Box 25425, Fed. Ctr. Denver, CO 80225. Paper copy $17.25, Microfiche $3.50. Geological Survey Open-File Report 81-329, March, 1982. 131 p, 16 Fig, 16 Tab, 2 Ref.

Descriptors: *Groundwater, *Water quality, *Hydrologic data, Wells, WEll data, Springs, Aquifers, Water level, Elevation, Water yield, Geohydrologic units, Sites, chemical analysis, Trace elements, *Pennsylvania, Susquehanna River basin, Potomac River basin.

Volume II of the Ground-Water Quality and Data on Wells and Springs in Pennsylvania presents ground-water quality and physical data on about 1,400 wells and springs in the Susquehanna and Potomac River basins in Pennsylvania. Locations are shown on site-location maps derived from the hydrologic unit map. Codes showing the geologic age and aquifer are provided. (USGS)
W83-01186

HYDROLOGIC MAPS OF THE OGALLALA AQUIFER, WEST-CENTRAL KANSAS, 1979-81,
Geological Survey, Garden City, KS. Water Resources Div.
J. M. Spinazola.
Available from OFSS, USGS. BOX 25425, Denver, CO 80225. Paper copy $18.00, Microfiche $2.00. Geological Survey Open-File Report 82-258, 1982. 4 Sheets, 5 Ref.

Descriptors: *Approximation method, *Hydrologic data, *Maps, *Mathematical models, *Water management, Water distribution, Groundwater, Aquifers, Water table, Irrigation, *Kansas, Ogallala aquifer, Kriging technique, Western Kansas Groundwater Management District No. 1.

A mathematical technique, called kriging, was programmed for a computer to interpolate hydrologic data based on a network of measured values in west-central Kansas. The computer program generated estimated values at the center of each 1-mile section in the Western Kansas Groundwater Management District No. 1 and facilitated contouring of selected hydrologic data that are needed in the effective management of ground water for irrigation. The kriging technique produced various maps that illustrated hydrologic conditions in the Ogallala aquifer, the principal source of water in west-central Kansas. Maps of the aquifer, which use a 3-year average, included the 1979-81 water-table altitudes, which ranged from about 2,580 to 3,720 feet; the 1979-81 saturated thicknesses, which ranged from about 0 to 250 feet; and the percentage changes in saturated thickness from 1950 to 1979-81, which ranged from about a 40-percent increase to a 100-percent decrease. A map showing errors of estimate also was provided as a measure of reliability for the 1979-81 water-table altitudes. Errors of estimate ranged from 2 to 24 feet. (USGS)
W83-01188

WATER-QUALITY AND HYDROGEOLOGIC DATA FOR THREE PHOSPHATE INDUSTRY WASTE-DISPOSAL SITES IN CENTRAL FLORIDA, 1979-80,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. L. Miller, and H. Sutcliffe Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-229675, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-84, 1982. 77 p, 30 Fig, 28 Tab, 3 Ref.

Descriptors: *Water quality, *Phosphates, *Waste disposal, *Water pollution, *On-site data collections, Chemical wastes, Surface waters, Chemical properties, Physical properties, Water sampling, Sites, Lithologic logs, Radiochemical analysis, Metals, Industrial plants, Industrial wastes, Nitrogen compounds, Organic compounds, *Florida.

This report is a complilation of geologic, hydrologic, and water-quality data and information on test holes collected in the vicinity of gypsum stack complexes at two phosphate chemical plants and one phosphatic clayey waste disposal pond at a phosphate mine and beneficiation plant in central Florida. The data were collected from September 1979 to October 1980 at thee AMAX Phosphate, Inc., chemical plant, Piney Point; the USS Agri-Chemicals chemical plant, Bartow; and the International Minerals and Chemical Corporation Clear Springs mine, Bartow. Approximmmtely 5,400 field and laboratory water-quality determinations on water samples were collected from about 78 test holes and 31 surface-water, rainfall, and other sampling sites at phosphate industry beneficiation and chemical plant waste-disposal operations. Maps show locations of sampling sites. (USGS)
W83-01190

WATER RESOURCES DATA, MINNESOTA, WATER YEAR 1981. VOLUME 2. UPPER MISSISSIPPI AND MISSOURI RIVER BASINS.
Geological Survey, St. Paul, MN. Water Resources Div.
Geological Survey Water-Data Report MN-81-2, 1982. 486 p, 10 fig, 1 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Minnesota, *Upper Mississippi River basin, *Missouri River Basin.

Water resources data for the 1981 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume contains discharge records for 70 gaging stations; stage and contents for 8 lakes and reservoirs; water quality for 41 stream stations, 3 partial-record stream stations, 4 partial-record lake stations, and 98 wells; and water levels for 287 observation wells. Also included are 109 high-flow partial-record stations and 27 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data, together with the data in Volume 1, represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota. (USGS)
W83-01397

WATER RESOURCES DATA, MINNESOTA, WATER YEAR 1981. VOLUME 1. GREAT LAKES AND SOURIS-RED-RAINY RIVER BASINS.
Geological Survey, St. Paul, MN. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-131979, Price codes: A11 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MN-81-1, 1982. 222 p, 9 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Stream-flow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical anal-

ysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Minnesota, *Great Lakes River basin, *Souris-Red-Rainy River basin.

Water resources data for the 1981 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume contains discharge records for 47 gaging stations; stage-only records for 1 gaging station; stage and contents for 5 lakes and reservoirs; water quality for 9 gaging stations, 1 stage station, 14 partial-record lake stations, and 21 wells; and water levels for 56 observation wells. Also included are 53 high-flow partial-record stations and 1 low-flow partial-record station. Additional water data were collected at various sites, not part of the systematic data-collection program and are published as miscellaneous measurements. These data, together with the data in Volume 2, represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota. (USGS)
W83-01398

WATER RESOURCES DATA, ILLINOIS, WATER YEAR 1981. VOLUME 2. ILLINOIS RIVER BASIN.
Geological Survey, Urbana, IL. Water Resources Div.
Geological Survey Water-Data Report IL-81-2, 1982. 538 p, 4 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Stream-flow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Illinois, *Illinois River basin.

Water resources data for the 1981 water year for Illinois consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 82 gaging stations, stage only at 2 gaging stations, stage only at 3 lake stations, water quality at 96 gaging stations and 10 wells, and water levels at 3 observation wells. Also included are data for 18 crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volume 1 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Illinois. (USGS)
W83-01399

WATER RESOURCES DATA, ILLINOIS, WATER YEAR 1981. VOLUME 1. ILLINOIS EXCEPT ILLINOIS RIVER BASIN.
Geological Survey, Urbana, IL. Water Resources Div.
Geological Survey Water-Data Report IL-81-1, 1982. 673 p, 4 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Illinois.

Water resources data for the 1981 water year for Illinois consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 94 gaging stations, stage only 17 gaging stations, stage and contents at 3 lakes and reservoirs, stage only at 1 lake station, and water quality at 121 gaging stations and 26 wells. Also included are data for 13 crest-stage partial-record stations and 22 low-flow partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volume 2 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Illinois. (USGS)
W83-01400

8. ENGINEERING WORKS

8A. Structures

IT'S ALL DOWNHILL FROM HERE. THE EREWHON RURAL WATER SUPPLY SCHEME,
G. James.
Soil and Water, Vol 17, No 2, p 10-16, April, 1981. 1 Tab.

Descriptors: *Irrigation engineering, *Gravity flow, *Water supply development, *New Zealand, Irrigation design, Engineering, Irrigation, Water demand, Water supply.

The development of a water supply scheme in Erewhon Riding (New Zealand) is described. The scheme is a completely gravitational one, bringing water of excellent quality to 27 farms with an area of 18,650 hectares. The source of supply, the Reporoa Bog catchment, lies at 1110 meters elevation in the north-western Ruahine Ranges. The intake was constructed at an elevation of 1105 meters in the plateau area just above the rimrock. Stage I is the linkage pipeline from the intake, across the Rangitikei River and into the main distribution area. Stage II pipeline branches off from the Stage I line 3 km below the intake and supplies the two stations on the eastern side of the river. Stage III is the reticulation throughout the main distribution areas of Pukeokahu and Pungatawa. Stage IV services two large farms in the more northerly Makokomiko area. Stage I is the key to the entire scheme, carrying water from the remote intake site across difficult terrain to a point from which the bulk of the scheme's participants can be supplied. One of the most difficult engineering feats in the scheme was the construction of the crossing of the Rangitikei Gorge. Engineers have used the inverted siphon technique. The water plumments in the pipes 585 meters down the side of the Gorge to the River below. On the way down it builds up a massive 600 pounds per square inch of pressure. Having reached the bottom, the water crosses the Rangitikei River and, still boiling through the pipe, rushes 300 meters up the other side to spill over the top and continue to the farmland it will irrigate. The pressure in the pipe is extremely important and thus is automatically monitored. The total cost of the scheme was $1,562,600, a unit cost of $83.78 per hectare. (Baker-FRC)
W83-01170

KURPSAI HYDROELECTRIC STATION ON THE NARYN RIVER,
P. Yu Kornev.
Hydrotechnical Construction, Vol. 15, No. 11, p 652-659, 1981-1982. 4 Fig, 4 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 8-13, November, 1981.

Descriptors: *Dam construction, *Dam design, *Dam foundations, *Concrete dams, *Gravity dams, *Concrete construction, *Hydroelectric plants, Dams, Concrete technology, Materials engineering, Concrete mixes, Naryn River, Kirgiz SSR, *USSR.

The design and construction of the Kurpsai hydroelectric station which was built to cover loads and provide a reserve in the interconnected power system of Central Asia are described. The main structures of the hydrostation are a gravity dam on the Naryn River, a spillway, and the powerhouse complex. The composition of the structures was closely in line with those used in sequence-type construction on mountain rivers. Use of sequence-type construction greatly shortened the preparatory period and volume of preparatory works. The penstocks of the dam were extended beyond the dam profile to its downstream face, allowing simpler construction of the seals of the contraction joints while the network of drainage galleries is distributed over the height of the dam. The Toktugal method also allows the zonal distribution of concrete so that material is used economically in the Kurpsai dam. Concreting was simplified due to elimination of pipe cooling of the dam, use of a practically uncooled concrete mix, automation of the compaction of the concrete mix, and elimination of the removal of the laitance from the horizontal joints in the internal zone of the dam. (Geiger-FRC)
W83-01234

MORE WATER FOR TEXAS COASTAL PLAINS.
Public Works, Vol 113, No 9, p 87-88, September, 1982.

Descriptors: *Reservoirs, *Pipelines, Water supply, Multipurpose projects, Palmetto Bend Project, Point Comfort, *Texas, Industrial water.

The multipurpose Palmetto Bend (Texas) Dam Project, designed to supply water to the Point Comfort region on the Gulf Coast, was recently completed. It includes the Palmetto Bend Dam across the Navidad River, the 11,000 acre Lake Texana reservoir, pumping station, a mile of surface level 30 inch steel pipe, and 13 miles of underground water transmission line. The steel pipe was lined with a 3/8 inch cement coating to minimize corrosion and water discoloration. Initially the reservoir will produce 20,000 acre ft of water to industries and 40,000 residents of the area, in which groundwater supplies have been depleted by overpumping of aquifers. (Cassar-FRC)
W83-01333

8B. Hydraulics

TENSOR STRUCTURE OF THE COEFFICIENT OF HYDRAULIC FRICTION,
All-Union Designing, Surveying and Scientific Research Inst., Moscow (USSR).
V. M. Lyatkher, and S. Ya. Shkol'nikov.
Water Resources, Vol 8, No 5, p 493-497, September-October, 1981. 10 Ref. Translated from Vodnye Resursy, No 5, p 58-62, September-October, 1981.

Descriptors: *Mathematical studies, *Flow velocity, *Shear stress, *Hydraulic friction, *Roughness coefficient, *Shallow water, Mathematical equations, Flow friction, Hydraulics, Flow pattern, Mathematical models, Model studies, Plane flow.

In open water bodies whose proposed dimensions are greater than the depth, flows are described by equations of the shallow-water theory or the planar problem. The tensor character of the coefficient of hydraulic friction in planar problems of hydraulic resistance was represented in situations of flow in the bottom layer in the presence of a laminar boundary layer, in the absence of a laminar boundary layer, in the presence of roughness of the bottom with a scalar structure, and in the presence of roughness of the bottom with a tensor structure. In the first two cases, the shear stress can be considered collinear with the bottom velocity measured at the level of the boundary of the laminar boundary layer or at the level of the characteristic projection of roughness. In the last case, the shear stress and bottom velocity are non-collinear. Two-dimensional equations of shallow-water theory were used to show the need to take into account the noncollinearity of the friction vector on the boundary of the flow and the characteristic velocity vector in terms of which this friction is expressed. A similar need arises when formulating the boundary conditions on a very rough bottom when solving three-dimensional equations of flow. (Geiger-FRC)
W83-01096

LABORATORY INVESTIGATIONS OF METHODS OF PROTECTING SUPPORTS FROM LOCAL SCOUR,

Moscow State Univ. (USSR). Hydrophysical Lab.
V. P. Gailevich, N. A. Mikhailova, N. B. Mulyukova, K. D. Savin , and P. M. Stepunin.
Water Resources, Vol 8, No 5, p 553-557, September-October, 1981. 6 Fig, 3 Ref. Translated from Vodnye Resursy, No 5, p 135-141, September-October, 1981.

Descriptors: *Scour, *Abrasion, *Channel scour, *Bridge design, *Mathematical studies, *Erosion control, *Flow velocity, Bridge construction, Bridges, Structural engineering, Channel flow, Erosion, Deformation, Bottom sediments, Graphical methods.

The characteristics of a local scour near a support in the case of forward motion of a flow as applied to a channel flow and longshore movement were studied at a 0.065 meter diameter cylinder, and two cylinders each with a diameter of 0.055 meters were used in the deformation experiments. Results showed that the depth of the scour hole increases with time up to a certain limiting value for a fixed value of the flow velocity. At a flow velocity less than the eroding velocity amarked increase of this limiting value was observed with increase of velocity. At a velocity greater than the eroding velocity, this relationship is much less pronounced. With increase of flow velocity, the area of the local scour increases substantially, especially in the rear part of the scour hole. Various blocks of tetrahedra or tetrapod shapes served as tough fillers of the scour hole and acted as a protection from scouring. Flexible contact blankets (carpets of slabs with cloth along the perimeter) protected the supports from undercutting and prevented the removal of sediments from the bottom surface near the support. Protection of supports by carpets without cloth was not as effective as protection by carpets with cloth. (Geiger-FRC)
W83-01098

THE EFFECT OF ASPECT RATIO ON LONGITUDINAL DIFFUSIVITY IN RECTANGULAR CHANNELS,

Liverpool Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
P. C. Chatwin, and P. J. Sullivan.
Journal of fluid Mechanics, Vol 120, p 347-358, July, 1982. 4 Fig, 1 Tab, 25 Ref.

Descriptors: *Channel flow, *Turbulent Flow, *Flow characteristics, Laminar flow, Aspect ratio, Diffusivity.

The value of Taylor's longitudinal diffusivity (D) for laminar flow in a channel of rectangular cross section of the dimensions a (width) and b (Height) is about 8Do for large values of the aspect ratio, a/b, when Do is the value of the longitudinal diffusivity obtained by ignoring all variation across the channel. This surprising result was originally obtained by Doshi et al. (1978). This paper considers the value of D in turbulent flow in a flat-bottomed channel of large aspect ratio, for which a formula for D is supported. The result is consistent with previous laboratory experiments by Fischer (1966). (Cassar-FRC)
W83-01115

NEW DATA ON SHAPE EFFECTS IN SMOOTH RECTANGULAR CHANNELS,

Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
A. K. Kazemipour, and C. J. Apelt.
Journal of Hydraulic Research, Vol 20, No 3, p 225-233, 1982. 4 Fig, 4 Ref.

Descriptors: *Channel flow, *Channel morphology, *Flow resistance, *Cross-sections, Open-channel flow, Reynolds number, Friction, Shape effects.

This paper reports new experimental data as an addendum to previous work on a method for dealing with the effects of cross-sectional shape on flow resistance in open channels. The method used for measuring the normal depth of flow was refined to overcome several problems. Data showed that the variation of friction factor with Reynolds number of the channel was larger than that for a smooth pipe at the same Reynolds number value. A shape factor established a simple correlation between the flow in circular pipes and open channels and permitted the friction factor and average velocity of the flow in the channel to be calculated from the universal resistance formulas and diagrams for circular pipes. (Cassar-FRC)
W83-01221

DIRECT SOLUTION FOR UNIFORM FLOWS IN ELLIPTICAL CHANNELS,

Changchun Geology Coll. (China). Dept. of Hydrologic Geology and Engineering Geology.
Y-Z. Zhang.
International Water Power and Dam Construction, Vol 34, No 8, p 20-21, August, 1982. 2 Fig.

Descriptors: *Channels, *Design criteria, *Flow characteristics, Flow, Mathematical equations, Model studies, *Uniform flow.

A method is presented with which the problems encountered in calculating the uniform flows passing an elliptical channel can be computed easily. Uniform flow means that the flow has a constant depth; thus it may be said to be at constant speed. The channel may have several different shapes. However, the elliptical section is widely used. Applying Manning's formula to an elliptical section and appropriately modifying the coordinate equations yields two equations for the channel flow times Manning's roughness coefficient divided by fractional powers of the bed slope and the semi-minor axis of the ellipse. A series of curves can be plotted based on these equations, forming a nomograph useful in solving problems of the type. (Baker-FRC)
W83-01284

PREDICTING CAVITATION IN TUNNEL SPILLWAYS,

Bureau of Reclamation, Denver, CO.
H. T. Falvey.
International Water Power and Dam Construction, Vol 34, No 8, p 13-15, August, 1982. 4 Fig, 6 Ref.

Descriptors: *Cavitation, *Spillways, *Prediction, Mathematical equations, Fluid mechanics, Flow, Tunnels, Tunnel hydraulics, Hydraulics.

A method of calculating the location of cavitation damage in spillways is presented. The method, together with experience curves, allows damage to be estimated as a function of duration of operation. Procedures are given to design aeration grooves which can protect spillways from cavitation damage. Although the results of the study were derived primarily from tunnel spillway experience, preliminary investigations indicate that the curves are also applicable to chutes. More field experience is needed to better define the shape of the damage curve. (Baker-FRC)
W83-01285

CHARACTERISTICS OF A LOW-HEAD PRESSURE CONDUIT,

Ministry of Energy, Sofia (Bulgaria).
S. Iliev, and L. Kalchev.
International Water Power and Dam Construction, Vol 34, No 8, p 28-31, August, 1982. 2 Fig, 1 Ref.

Descriptors: Model studies, *Conduits, *Pressure head, *Pressure conduits, Pressure distribution, Reservoirs, Ponds, Surges, Surge tanks, Flow characteristics, Hydrodynamics, Fluid mechanics.

Hydrodynamic models of a low-head pressure conduit between a reservoir and its headpond have been developed. A slowly changing movement of water in the conduit and pond is considered. The latter may operate on a daily or weekly cycle, or alternatively, it may be considered as a surge chamber. The following assumptions are made in considering this model. First, the flow is uni-dimensional, making it possible to use average velocities in the cross-sections. Secondly, the pipe walls do not deform, and thus the cross-sectional area depends only on the site and is not a function of time. Third, the water does not contract, and thus the flow in the conduit depends only on time and is not a function of the site. Fourth, the water surface area in the headpond changes linearly depending on the water level, as was postulated in a previous article. The method allows accurate complex hydrodynamic studies to be made of the elements of the system for scientific purposes and for solving the technical and economic problems of design, construction and operation. (Baker-FRC)
W83-01286

EROSION OF JETS WITH CAVITATION INDUCERS,

Department of Science and Technology, New Delhi (India).
K. S. Janakiram, and B. C. Syamala Rao.
International Water Power and Dam Construction, Vol 34, No 8, p 32-36, August, 1982. 12 Fig, 15 Ref.

Descriptors: *Erosion, *Cavitation, *Jets, Water velocity, Flow velocity, Corrosion, Metals, Aluminum, Fluid mechanics, Flow characteristics.

Detailed experiments are described which were carried out to study the erosion of aluminum by the impingement of jets in which cavitation is induced. The dependence of erosion on stand-off distance and jet velocity is investigated, and the flow characteristics of jets with varying cavitation numbers are also discussed. It was concluded that the normalized erosion rate increases initially, attains a peak, and then decreases with an increase in stand-off distance. The cavity patterns obtained for cavitating jets are similar to those reported in cavitation studies. The length and width of the aavity increased with a decrease in the cavitation number. The increase is rapid at small cavitation numbers and slow at large cavitation numbers. The variation of volume loss with net velocity may be expressed by a power relationship. That is, erosion varies with the fourth to ninth power. With an increase in cavitation number the normalized erosion rate first decreases rapidly and then becomes almost constant. The normalized erosion rate increases with an increase in the frequency of impingement, and the dimensional quantity of volume loss varies with the fourth to ninth power of frequency. (Baker-FRC)
W83-01287

DYNAMIC EQUATIONS FOR STEADY SPATIALLY VARIED OPEN CHANNEL FLOW: A CRITICAL REVIEW,

Sri Venkateswara Univ., Tirupati (India). Coll. of Engineering.
P. Venkataraman, M. S. Nasser, and A. S. Ramamurthy.
Advances in Water Resources, Vol 5, No 2, p 66-72, June, 1982. 4 Fig, 1 Tab, 36 Ref.

Descriptors: *Mathematical equations, *Open-channel flow, Flow, Mathematical studies, Dynamics, *Reviews, Spatial distribution.

A review of the dynamic equations governing steady spatially varied flow in open channels is presented. The equations are derived by employing either the momentum or the energy principle: the choice of the method employed is based on convenience. Nevertheless, the two approaches yield different results when applied to a particular flow situation. Recent researches have established that this anomaly is due to the omission of the influence of the lateral flow. The inconsistencies existing among the different forms of these equations and the rather incomplete nature of their derivation are discussed. It is believed that with the present state of knowledge, it is possible to obtain identical spatially varied flow profiles when the influencing parameters are properly evaluated, whether one uses the momentum or the energy approach. The need for further study to provide a better understanding of this practically important phenomenon is established, and potential research directions are defined. Recent contributions to the analysis of the hydraulic characteristics of the spatially varied flow phenomenon and the delineation of the spatially varied flow profiles into eight possible patterns are also presented. (Baker-FRC)
W83-01395

8C. Hydraulic Machinery

MODIFIED GRAPHICAL DETERMINATION OF SUBMAIN SIZE,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
W. R. DeTar.
Transactions of the ASAE, Vol 25, No 3, p 695-696, May/June, 1982. 1 Tab, 9 Ref.

Descriptors: *Pipes, *Graphical analysis, Pipelines, Water mains, Conveyance structures, Irrigation, Water transport, *Graphical methods, Mathematical studies, Irrigation design.

A simplified method for obtaining multipliers for a variety of pipe types and for any number of outlets is presented. The procedure involves the use of the correction factor commonly used in sprinkler lateral design. A table of three correction factors is given. The correction factor as used in the design of untapered sprinkler laterals can be used in the graphical determination of the proper tapering of submains in solid-set systems on non-uniform slopes. Use of this correction factor represents a considerable improvement in the technique presented in DeTar. With this improvement it becomes possible to determine the pressure distribution in perforated trickle laterals that descend slopes of any kind, and thus find the proper limit on lateral lengths. (Baker-FRC)
W83-01101

AXIAL FLOW-INDUCED VIBRATIONS IN LARGE HIGH-HEAD MACHINES,
Laval Univ. (Quebec). Dept. of Mechanical Engineering.
H. Netsch, and A. Giacometti.
International Water Power and Dam Construction, Vol. 34, No. 8, p 21-27, August, 1982. 13 Fig, 8 Ref.

Descriptors: Construction, *Hydraulic machinery, *Vibrations, *Hydraulic equipment, Flow velocity, Water velocity, Design criteria.

Construction requirements for the increasingly larger hydraulic machines coming into use, designed to operate under rather high heads and associated high water velocities, may be the cause of new vibration problems. Such problems, causes and remedial measures are considered in this article. Several choices are available to limit the impact of the wake of the spiral case tongue upon passage of the leading edges of the runner blades. For example, for large, high-head Francis turbines, the energy level of the water flows on both sides of the tongue wall could be equalized by several connecting holes. Alternatively, a connecting pipe could be located a little upstream of the tongue trailing edge and run between the incoming flow in the spiral case and the residual flow at the end of the water travel inside the spiral case. At times when the amplitude of the vibrations exceeds a safe level, attempts must be made to alter the head cover geometry by bolting or welding on stiffening elements or rings to shift the critical frequency of the cover toward a resonance-free level. (Baker-FRC)
W83-01311

SOME DESIGN FACTORS FOR THE BATH COUNTY TRASHRACKS,
Harza Engineering Co., Chicago, IL.
W. S. Hamilton, and J. P. Tullis.
International Water Power and Dam Construction, Vol. 34, No. 8, p 16-19, August, 1982. 5 Fig.

Descriptors: *Design criteria, *Trashracks, Flow pattern, Flow, Flow velocity, Turbines, Hydraulic engineering, Construction, Pumps, Virginia.

When a Bath County pump-turbine is generating power it discharges water into the lower reservoir through a conventional two-bay elbow draft tube. To protect the machine when it is pumping, trashrack panels span each bay downstream from the draft tube exit. They are located 24.4 m from the turbine centerline and 7.6 m downstream from the draft tube exit. Each machine may discharge as much as 153 cu m/second through a two-bay area at the draft tube exit of about 50 sq m. Because nearly all of the flow may travel through one bay instead of two, and because the velocity distribution in that single passage may be severely nonuniform, one may anticipate a local velocity as high as 9 to 12 m/s at the racks. Water velocity measurements were made at the draft tube exits of the pumped-storage project model and indicated that the outflow was very badly distributed. Potentially damaging high-frequency pulsations occurred as well. The way in which these conditions were measured, analyzed and scaled-up for the design of the trashracks is described. (Baker-FRC)
W83-01312

ADVANCES IN WATER AND WASTEWATER VALVES,
Consulting Engineer (St. Joseph), Vol 59, No 3, P 105-109, September, 1982. 6 Fig.

Descriptors: *Valves, *Wastewater treatment, *Water treatment, Equipment design, Gate valves, Butterfly valves, Plug valves, Ball valves, Check valves, Actuators, Hydraulic equipment, Hydraulic valves.

One of the most commonly used valves is the metal-seated double-disc gate valve. Flow shutoff is good, particularly at higher pressures. Gate valves are not recommended for precise flow control nor for continuous operation in the throttled position. One advantage of these valves is ease of maintenance. Leakage problems which limited application of the gate valve have been largely overcome by redesign of the valve itself and by the use of various synthetic coatings. Constant improvement has been noted over the past 10 years in the butterfly valve. Improvements are also noted in plug and ball valves and the check valve. Valve actuators have also undergone much study, with resulting advancements being made in this area as well. (Baker-FRC)
W83-01340

8D. Soil Mechanics

MEASURING STATION TO DETERMINE PORE WATER PRESSURE - ZERVREILA ARCH DAM (MESSANLAGE FUR PORENWASSERDUCK - BOGENSTAUMAUER ZERVREILA),
Solexperts A.G., Zurich (Switzerland).
For primary bibliographic entry see Field 8G.
W83-01100

DAM KLEINE KINZIG - DESIGN AND CONSTRUCTION (TALSPERRE KLEINE KINZIG - ENTWURF UND AUSFUHRUNG),
Ingenieurbouro, Munich (Germany, F.R.).
A. Eppler.
Wasserwirtschaft, Vol 71, No 12, p 349-353, December, 1981. 5 Fig, 3 Ref. English summary.

Descriptors: *Rockfill dams, *Dam design, *Dam construction, *Potable water, *Geology, Design criteria, Construction, *Federal Republic of Germany, Kleine Kinzig dam, Hydraulic engineering, Granites, Crystalline rocks, Asphaltic concrete, Grouting, Bedrock, Flood protection, Outlet tower, Outlet channels, Sandstones, Sedimentary rocks.

The construction of the Kleine Kinzig dam was considered necessary to ensure an adequate supply of drinking water for the central Black Forest (Federal Republic of Germany), where although rainfall is quite high, little natural water storage occurs for geological reasons. Topology and geology at the dam site are favorable. The mountains are composed of red sandstone resting on granite, and the border between old and new red sandstones is approximately at the ideal water level of the reservoir. The old red sandstone forms a natural sealing layer under the reservoir. The dam will be 74 m high, and the crown road will be 340 m long and 8 m wide. It is a rock-fill dam with an asphaltic concrete impervious core and requires 1.4 million cu m of fill material, half of which as been put into place. The impervious core, 65 m thick and inclining to the downstream side for the top 16 m, is connected to the bedrock compression by a control tunnel that is also connected to the valley sides so that these help bear the brunt of forces created in the dam. An access tunnel provides entrance to the control tunnel. The upstream half of the dam is filled with granite with an outer layer of syenite to provide drainage, while the downstream part consists of an inner zone of material from the valley walls with an outer covering of granite and a surface filter under the outer half of this section. The inner zone is only slightly permeable, and while it is being filled leaks are repaired and rock fissures plugged. Facilities for the determination of deformation, seepage, and leaks in and around the grout curtain are being installed. An outlet tower with two extraction conduits has been constructed to extract water from the reservoir. For the purpose of flood protection, a 16-m diameter inlet tulip will be constructed that will connect with the stilling basin. It will be able to divert 113 cu m/sec of water. (Gish-FRC)
W83-01110

THE RECONSTRUCTION OF THE SCHLICHEM BARRAGE NEAR SCHOMBERG IN THE ZOLLERNALB DISTRICT (DIE SANIERUNG DER SCHLICHEMTALSPERRE BEI SCHOMBERG IN ZOLLERNALBKREIS),
G. Wagner.
Wasserwirtschaft, Vol 71, No 12, p 364-367, December, 1981. 3 Fig.

Descriptors: *Rockfill dams, *Dam design, *Dam construction, *Maintenance, *Federal Republic of Germany, Schlichem dam, Recreation, Reservoir capacity, Industrial water, Flood protection, Dam stability, Seepage, Dam construction, Filters.

The renovation of the Schlichem dam on the northwestern border of the Swabian Jura (Federal Republic of Germany) and historical circumstances leading up to the renovation are described. The rockfill dam serves three purposes: the provision of industrial water for an oil shale carbonizing plant, flood protection, and recreation. During the planning stage of the dam, begun in 1937, many changes were made with regard to its purpose and size, resulting in the dam being built 5 m higher than originally designed but with its base area remaining almost the same. The faulty design led to a slippage of several hundred cu m as early as 1945, and in 1968 studies revealed that the crown had slipped 33 cm in the horizontal and 25 cm in the vertical plane. Fissures in the crown road surface and in the outlet structure had previously been observed. Renovations were planned in 1970 and begun in 1976. Before the main renovations were started, a rockfill auxiliary dam with a fish ladder was built 1 km upstream of the main dam to function as a boulder and mud catcher and to provide fishing. The main dam consists of supporting bodies of limestone material on both sides with a huge sealing zone of clay-like material and a dome-shaped transition zone in between. However, the water content of the available clay was too high, and together with the too-steep embankment inclination near the crown, caused instability on the downstream side. This will be solved by adding fill so that the base width will be increased 40 m to 120 m. The old crown will be cut down by 5 m and replaced by a more stable material with optimal pore water content. A new filter layer will be constructed from the existing rock supporting body underneath the crown in order to remove a seepage line. Because the existing reservoir capacity is inadequate for flood protection it will be increased to 1.2 cu hm (providing 900,000 cu m for flood waters) by increasing crown height by 2 m. (Gish-FRC)
W83-01111

CONSTRUCTION OF THE DAM TO SUPPLY POTABLE WATER ON THE 'KLEINE KINZIG' RIVER NEAR FREUDENSTADT (BAUABLAUF AN DER TRINKWASSERTALSPERRE KLEINE KINZIG BEI FREUDENSTADT),
Zweckverband Wasserversorgung Kleine Kinzig, Freudenstadt (Germany, F.R.).
F. Frey, and J. Neumann.

Wasserwirtschaft, Vol 71, No 12, p 354-356, December, 1981. 1 Fig. English Summary.

Descriptors: *Rockfill dams, *Dam construction, *Potable water, *Dam design, Hydraulic engineering, *Federal Republic of Germany, Construction, Granites, Crystalline rocks, Concretes, Asphaltic concrete, Grouting, Flood protection, Kleine Kinzig dam.

The state of construction of the Kleine Kinzig dam in the Black Forest, FRG (Federal Republic of Germany) is described. At 70 m, the rock-fill dam, designed to provide drinking water, will be the highest dam with an asphaltic concrete impervious core in the FRG. On both sides of the core is an approximately 1.5-m thick transition layer of syenite with grains of 0/56mm. The downstream port of the dam consists of material from the valley sides and is covered by an approximately 8-m thick granite covering forming the embankment. The upstream part is filled with granite with a grain size of 0-400 mm, on top of which is a drainage layer of syenite. The construction of a waterworks at the downstream foot of the dam is in progress simultaneously with dam construction. A test filling of granite in the area of the upstream foot took place in late fall, 1980, and withstood the ensuing winter well; vulnerability of the fill to deformation was ruled out. The volume of the dam is 1.4 million cu m. Construction was expected to take 14 months to be complete in late summer 1982. On the upstream side fine-grained granite or syenite must be inserted in the contact zone between valley side and fill. On the downstream foundation surface fissures in the rock are being cleaned and filled. The impervious core is being constructed by a special instrument in 20-cm layers to a thickness of about 65 cm; the transition layers can be completed at the same time. At the end of each work day, the permeable fill is compacted so that possible precipitation will run off. To prevent seepage through and around the dam, a grout curtain is being constructed from the completed control tunnel; the injection program is variable so that the depth of the curtain can be adjusted according to need. (Gish-FRC)
W83-01112

8F. Concrete

KURPSAI HYDROELECTRIC STATION ON THE NARYN RIVER,
For primary bibliographic entry see Field 8A.
W83-01234

8G. Materials

MEASURING STATION TO DETERMINE PORE WATER PRESSURE - ZERVREILA ARCH DAM (MESSANLAGE FUR PORENWASSERDUCK - BOGENSTAUMAUER ZERVREILA),
Solexperts A.G., Zurich (Switzerland).
A. Thut.
Wasser, Energie, Luft, Vol 73, No 4, p 85-86, April, 1981. 4 Fig, 1 Ref.

Descriptors: *Pore pressure, *Dams, *Pressure-measuring instruments, *Piezometers, Gages, Zervreila dam, *Switzerland, Water pressure, Water level fluctuations, Hydraulic engineering, Uplift pressure, Arch dams, Valve transmitters, Gloetzl valve transmitter, Installation, Manometers, Bedrock, Permeability, Geology.

The measuring system installed to determine pore water pressure and uplift at the Zervreila arch dam in Switzerland is described and discussed. The choice of such a measuring system depends on the permeability of the bedrock, the pressures to be measured, and the goal of the measurements. Every change in water level of the dammed lake results in a change in pore water pressure, so that if this pressure is to be determined immediately, volume change in the system must be minimal. With a simple gage, the pressure in the rock is determined by means of water level in the gage pipe; thus when the pressure changes, a time lag occurs while the pipe fills or empties. The filling time of the piezometer pipe is dependent on the permeability of the rock, and for a permeability of 0.0000001 cm/sec the time lag is an unacceptable 17 days. By mounting a manometer at the end of the pipe, the volume change is greatly reduced, but this device requires a water level higher than the manometer and absolute watertightness, and cannot be used continuously due to the inevitable fluctuations in lake level. At the Zervreila dam, Gloetzl-valve transmitters were installed in three storeys to a depth of 41 m. The diameter of the piezometer bore was 76 mm. Near the valve transmitter is a 5-m long filter section of quartz sand. The storey sealing consists of clay balls and cement/water grouting. The valve transmitter consists of a filtering stone and an adjoining small chamber at the transmitter, both of which are saturated before installation. Pore water pressure has a direct effect across the filter and chamber on a membrane behind the water chamber. The volume change is thus completely dependent on water compressibility. In the feed pipe to the transmitter a pressure is produced pneumatically until the membrane opens. (Gish-FRC)
W83-01100

RESULTS OF PRELIMINARY EXPERIMENTS ON THE INFLUENCE OF FABRICS ON THE MIGRATION OF GROUNDWATER AND WATER-SOLUBLE MINERALS IN THE CAPILLARY FRINGE,
Queen Mary Coll., London (England). Dept. of Geological Science.
W. J. French, A. B. Poole, P. Ravenscroft, and M. Khiabani.
Quarterly Journal of Engineering Geology, Vol 15, No 3, p 187-199, 1982. 14 Fig, 6 Tab, 12 Ref.

Descriptors: *Groundwater movement, *Migration, *Minerals, *Capillarity, Capillary water, Groundwater management, Fabrics, Terram, Filtram, Membranes, Permeability, Unsaturated soils.

Laboratory experiments are reported in which soil and groundwater regimes approximating those of hot arid areas have been modelled. The motions of saline groundwater and the solution and precipitation of phases such as halite, gypsum and calcite in the capillary fringe have been studied. Tthe nonwoven permeable fabrics 'Terram' and 'Filtram' have been placed in the soil beds, and it is shown that fabrics such as 'Filtram' are able to prevent both the capillary rise of moisture and the downward penetration of water infiltrating from above. The lower surface of the fabric may act as a locus for mineral precipitation, but crystalline phases have not been found growing into the pores of the fabric. The work is relevant to both horticultural and engineering applications of the fabrics. The first experiments have been followed by larger scale experiments, which are not at this point complete, in which further details of the behavior of permeable membranes in unsaturated soils are being studied, including their ability to protect building materials. (Baker-FRC)
W83-01253

CRITICAL WATER SUPPLY RESTORED: CH2M HILL CALLED TO RESCUE OF COLLAPSED IRRIGATION CANAL.
Irrigation Journal, The Annual Answer Book, Vol. 30, No. 6, p 120, 1980.

Descriptors: *Canals, *Irrigation canals, *Pipes, Conduits, Water conveyance.

A 70-year old concrete irrigation canal, the sole source of water for a $60 million per year orchard crop, was returned to service 18 days after collapse of a 100-ft section located 400 ft up a vertical cliff. The undermining of the foundation was caused by overflow from a cloudburst and clogging with volcanic debris from the Mount St. Helens, Washington, eruption. After debris removal in inhospitable terrain, a helicopter airlifted necessary supplies and equipment. A steel support structure was fabricated in the valley below and 15 ft steel columns were airlifted to the cliff. Six 25-ft sections of 102 inch corrugated steep pipe were lifted from the valley floor and connected to the existing section of the flume. (Cassar-FRC)
W83-01316

8I. Fisheries Engineering

SOME OBSERVATIONS ON THE ECOLOGY AND FISH MANAGEMENT OF RESERVOIRS IN THE UNITED STATES,
Fish and Wildlife Service, Slidell, LA.
For primary bibliographic entry see Field 6G.
W83-01225

SIMULATION OF FISH MOVEMENTS IN A LARGE HYDRO-ELECTRIC RESERVOIR: LG-2,
Sherbrooke Univ. (Quebec). Faculte des Sciences Appliquees.
For primary bibliographic entry see Field 6G.
W83-01229

SOIL CONSERVATION PROTECTS THE TROUT,
Waikato Valley Authority, Hamilton (New Zealand).
For primary bibliographic entry see Field 4D.
W83-01294

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

ANNOTATED BIBLIOGRAPHY OF THE GEOLOGY AND HYDROLOGY OF THE SURFICIAL AQUIFERS IN DADE, BROWARD, AND PALM BEACH COUNTIES, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. R. Causaras.
Available from OFSS USGS. Box 25425 Fed. Ctr. Denver, CO 80025. Paper copy $8.00, Microfiche $3.50. Geological Survey Open-File Report 82-154, 1982. 59 p.

Descriptors: *Bibliographics, Hydrology, Geology, Surveys, Aquifers, Groundwater, Water quality, Abstracts, *Florida, Dade County, Broward County, Palm Beach County.

References and abstracts from 149 hydrologic and geologic investigations concerning the surficial aquifers of southeast Florida have been compiled to prepare an annotated bibliography. The references are listed alphabetically by the author's name. (USGS)
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